

**Florida Department of Education  
Curriculum Framework**

**Program Title:** Geospatial/Geographic Information Systems (GIS) Technology  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

Career Certificate Program	
Program Number	T860020
CIP Number	0545070214
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	FL-TSA, SkillsUSA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

### **Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic benchmarks and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

This program is designed to prepare students for employment as a GIS Technology Assistant or a GIS Technician. Students are introduced to the concepts of Geospatial/Geographic Information System (GIS)— an organized collection of computer hardware, specialized software, and geographic data designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced (spatial) information. Students will research and learn detailed information about global and local matters related to political, environmental, commercial, and other areas, through the use of specialized geospatial tools and products.

This program offers a broad foundation of core knowledge, transferable skills, and applications to prepare students for future careers as skilled GIS professionals. As GIS is a rapidly developing field, GIS professionals are in high demand and this program will prepare students for entry into the field. The content of this program includes the development of the following computer skills and concepts: computer application skills (e.g., word processing, spreadsheet, presentation, and desktop publishing), Internet browser applications, computer programming, advanced web tools, and basic concepts of relational databases and the tools to use them. Additionally, this program stresses understanding and demonstration of GIS

concepts, project management strategies, applications of geographic data elements and remotely sensed data, visualizations of spatial data, data inventory management, demographic and economic data analysis, data collection methods and techniques, and extensive exploration of GIS careers and job opportunities.

**Additional Information** relevant to this Career and Technical Education (CTE) program at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of two occupational completion points.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	GIS0090	GIS Technician Assistant	BUS ED @2	300 hours	15-1199
B	GIS0091	GIS Technician	COMPU SCI 6 ENG&TEC ED1@2 TEC ED @2 TEC EN AID @7 G <i>Any Vocational Coverage suitable for Secondary or CAREER CERTIFICATE PROGRAM implementation accompanied by industry-recognized GIS Technician certification in accordance with FS 1012.39</i>	300 hours	15-1199

**Program Implementation**

This program emphasizes the development of abilities and/or awareness necessary to function in a highly technological society. The use of cooperative learning groups is recommended. By learning and practicing group process skills, students will be prepared to work "together" in real work situations. Program graduates will develop enhanced self-esteem as well as the problem-solving and teamwork skills necessary to succeed in careers and postsecondary education. Students will gain knowledge about career paths, have access to business role models, and have choices they would not otherwise have.

The Geospatial/Geographic Information Systems (GIS) Technology program places a strong emphasis on workplace learning. Shadowing and mentoring experiences with GIS professionals along with on-site trips to local businesses connect classroom learning to the workplace. In-class guest speakers bring the real world into the classroom.

Although a variety of GIS software applications and utilities are available in industry, the standards specified in this program focus on the underlying functions and associated competencies in alignment with the STARS program.

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

After successfully completing this course the student will be able to perform the following:

- 01.0 Perform general computer application activities.
- 02.0 Design and prepare multi-view drawings.
- 03.0 Understand the history, societal implications, underlying theories, and industry applications of GIS technology.
- 04.0 Understand map types, purposes, and information they depict.
- 05.0 Demonstrate an understanding of coordinate systems, projections, scale, orthorectified imagery, earth geometry and geodesy and other concepts integral to geographic information systems.
- 06.0 Create, change, validate and manipulate data used to create a map.
- 07.0 Demonstrate language arts knowledge and skills.
- 08.0 Demonstrate mathematics knowledge and skills.
- 09.0 Demonstrate science knowledge and skills.
- 10.0 Explain the importance of employability skill and entrepreneurship skills.
- 11.0 Demonstrate personal money-management concepts, procedures, and strategies.
- 12.0 Customize the display of geospatial data.
- 13.0 Manage, query, and symbolize geospatial data.
- 14.0 Create a geospatial model.
- 15.0 Introduction to data collection and uses.
- 16.0 Layout and print maps.
- 17.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 18.0 Solve problems using critical thinking skills, creativity and innovation.
- 19.0 Use information technology tools.
- 20.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- 21.0 Describe the importance of professional ethics and legal responsibilities.
- 22.0 Create surface models of spatial data to map distance.
- 23.0 Demonstrate density models of spatial data.
- 24.0 Demonstrate different surface interpolation methods.
- 25.0 Demonstrate different surface analysis methods.
- 26.0 Use different statistical methods in raster analysis.
- 27.0 Interpret different types of spatial data used in 3D visualization and analysis.
- 28.0 Create network datasets using existing shapefiles and geodatabases.
- 29.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 30.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 31.0 Explain the importance of employability skill and entrepreneurship skills.
- 32.0 Create a 3D map using a GPS unit for use in a class wide project.
- 33.0 Create an extensive campus-based geospatial project.
- 34.0 Design an individual career plan that reflects the transition from school to work, lifelong learning, and personal and professional goals.

Florida Department of Education  
 Student Performance Standards

Program Title: Geospatial/Geographic Information Systems (GIS) Technology  
 Career Certificate Program Number: T860020

**Course Number: GIS0090**  
**Occupational Completion Point: A**  
**GIS Technician Assistant – 300 Hours – SOC Code 15-1199**

01.0	Perform general computer application activities. – The student will be able to:
01.01	Develop keyboarding skills to enter and manipulate text and data.
01.02	Demonstrate basic computer file management skills.
01.03	Use reference materials such as on-line help, vendor bulletin boards, tutorials, and manuals available for application software.
01.04	Use spreadsheet, presentation software, and integrated software packages to enhance communication.
01.05	Use computer networks (e.g., Internet, on-line databases) to facilitate collaborative or individual learning and communication.
01.06	Use computers to access, retrieve, organize, process, maintain, interpret, and evaluate data and information.
01.07	Prepare presentation graphics.
01.08	Apply geometric construction techniques.
02.0	Design and prepare multi-view drawings. – The student will be able to:
02.01	Analyze challenges and identify solutions for design problems.
02.02	Investigate the use of space, scale and environmental features to create three-dimensional form, or the illusion of depth and form.
02.03	Prepare multi-view scaled drawings or maps.
02.04	Select proper drawing scale, views and layout.
02.05	Prepare drawings containing horizontal and vertical surfaces.
02.06	Prepare drawings containing circles and/or arcs.
02.07	Prepare detail drawings.
02.08	Draw a site plan.

03.0	Understand the history, societal implications, underlying theories, and industry applications of GIS technology. – The student will be able to:
03.01	Discuss the history and societal implications of mapping and GIS.
03.02	Describe the underlying theories of GIS.
03.03	Identify industry applications for GIS technology.
04.0	Understand map types, purposes, and information they depict. – The student will be able to:
04.01	Compare and contrast various forms of maps in terms of purpose, information, and application.
04.02	Convert latitude and longitude information between DMS and DD forms.
04.03	Demonstrate how to read a topographical map.
04.04	Identify different types of maps.
04.05	List the major elements of maps.
04.06	Calculate straight line distances on the earth from latitudes and longitudes.
05.0	Demonstrate an understanding of coordinate systems, projections, scale, orthorectified imagery, earth geometry and geodesy and other concepts integral to geographic information systems. – The student will be able to:
05.01	Identify terminology associated with map coordinate systems and location, map scale, map projections, and orienteering.
05.02	Discuss the roles of several geometric approximations of the earth's shape, such as geoids, ellipsoids, and spheres.
05.03	Describe characteristics of appropriate uses of common geospatial coordinate systems, such as geographic (latitude and longitude), UTM and State Plane coordinates.
05.04	Interpret location using the Geographic Coordinate System to identify absolute location.
05.05	Explain, interpret and describe the characteristics and uses of common map datum and projections.
05.06	Explain the Universe Transverse Mercator (UTM) coordinate system.
05.07	Interpret locations using the UTM coordinate system.
05.08	Demonstrate an understanding of how maps are created using aerial photography.
05.09	Explain the State Plane Coordinate System (SPC).
05.10	Interpret locations using the SPC system.
05.11	Convert data between different datums and projections.

05.12	Explain the difference between aerial and orthorectified images.
06.0	Create, change, validate and manipulate data used to create a map. – The student will be able to:
06.01	Identify sources of GIS information and their applicability to GIS projects.
06.02	Identify the primary components of the GIS Project Management Model.
06.03	Discuss the elements of geospatial data quality including geometric accuracy thematic accuracy, resolution, precision and fitness for use.
06.04	Create and customize a localized satellite map scenario using an appropriate GIS software application.
06.05	Demonstrate the use of zooming, identifying, bookmarks, selecting, and panning tools.
06.06	Utilize a GPS unit to collect waypoints, measure distance, and calculate area.
06.07	Explain the components of the map display and the tools in the tool bars of common mapping software.
06.08	Explain the need for and uses of metadata.
06.09	Demonstrate geocoding addresses, editing symbols, clipping data layers, and creating buffers.
06.10	Demonstrate various styles of displaying symbols of data, sorting querying, and selection techniques.
06.11	Demonstrate editing feature data.
06.12	Demonstrate how to georeference an Image Data Layer and add Control Points.
07.0	Demonstrate language arts knowledge and skills. – The student will be able to:
07.01	Locate, comprehend and evaluate key elements of oral and written information.
07.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
07.03	Present information formally and informally for specific purposes and audiences.
07.04	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
07.05	Present information formally and informally for specific purposes and audiences.
08.0	Demonstrate mathematics knowledge and skills. – The student will be able to:
08.01	Demonstrate knowledge of arithmetic operations.
08.02	Analyze and apply data and measurements to solve problems and interpret documents.



08.03	Construct charts/tables/graphs using functions and data.
09.0	Demonstrate science knowledge and skills. – The student will be able to:
09.01	Discuss the role of creativity in constructing scientific questions, methods and explanations.
09.02	Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.
09.03	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
09.04	Present information formally and informally for specific purposes and audiences.
10.0	Explain the importance of employability skill and entrepreneurship skills. – The student will be able to:
10.01	Identify and demonstrate positive work behaviors needed to be employable.
10.02	Develop personal career plan that includes goals, objectives, and strategies.
10.03	Examine licensing, certification, and industry credentialing requirements.
10.04	Maintain a career portfolio to document knowledge, skills, and experience.
10.05	Evaluate and compare employment opportunities that match career goals.
10.06	Identify and exhibit traits for retaining employment.
10.07	Identify opportunities and research requirements for career advancement.
10.08	Research the benefits of ongoing professional development.
10.09	Examine and describe entrepreneurship opportunities as a career planning option.
11.0	Demonstrate personal money-management concepts, procedures, and strategies. – The student will be able to:
11.01	Identify and describe the services and legal responsibilities of financial institutions.
11.02	Describe the effect of money management on personal and career goals.
11.03	Develop a personal budget and financial goals.
11.04	Complete financial instruments for making deposits and withdrawals.
11.05	Maintain financial records.
11.06	Read and reconcile financial statements.

11.07	Research, compare and contrast investment opportunities.
12.0	Customize the display of geospatial data. – The student will be able to:
12.01	Edit Layer Properties.
12.02	Create Layer Files.
12.03	Edit an attribute table by adding a new field with calculating values.
12.04	Perform relates and joins with data tables.
13.0	Manage, query, and symbolize geospatial data. – The student will be able to:
13.01	Label features.
13.02	Insert, copy, and paste data into new data frames.
13.03	Create graphs and reports from data.
13.04	Demonstrate how to analyze land use, population, and flood zone data.
13.05	Create geospatial data.
13.06	Symbolize a raster layer.
13.07	Geocode addresses and resolve unmatched addresses.
13.08	Use dissolve features, hyperlink, spatially join data, and create buffer functions.
13.09	Demonstrate understanding of the conceptual foundations of which geographic information systems (GIS) are based, including the problem of representing change over time and the imprecision and uncertainty that characterizes all geographic information.
13.10	Compare advantages and disadvantages of standard spatial data models, including the nature of vector, raster, and object-oriented models, in the context of spatial data used in the workplace.
14.0	Create a geospatial model. – The student will be able to:
14.01	Create a geodatabase, import existing feature classes into a geodatabase, and import multiple feature classes to a geodatabase.
14.02	Plan and build a local data inventory.
14.03	Acquire and integrate a variety of field data, image data, vector data, and attribute data to create, update and maintain GIS databases.
15.0	Introduction to data collection and uses. – The student will be able to:
15.01	Explain spatial reference.

15.02	Demonstrate how to georeference an Image Data Layer and add Control Points.
15.03	Use geospatial software tools to perform basic GIS hardware and software capabilities, including real-time GPS/GIS mapping systems.
15.04	Manipulate digital elevation models (DEM's) to create slope, aspect, view shed and hill shade layers.
15.05	Register aerial photographs or satellite images to a specific geographical coordinate system.
16.0	Layout and print maps. – The student will be able to:
16.01	Demonstrate the ability to define page margins and parameters for printing a specific size.
16.02	Demonstrate effective use of map elements that must be included in a map including title, author, data, legend, scale bar, north arrow.
16.03	Demonstrate effective use of page space through map scale and frame size.
17.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
17.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
17.02	Locate, organize and reference written information from various sources.
17.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
17.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
17.05	Apply active listening skills to obtain and clarify information.
17.06	Develop and interpret tables and charts to support written and oral communications.
17.07	Exhibit public relations skills that aid in achieving customer satisfaction.
18.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
18.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
18.02	Employ critical thinking and interpersonal skills to resolve conflicts.
18.03	Identify and document workplace performance goals and monitor progress toward those goals.
18.04	Conduct technical research to gather information necessary for decision-making.
19.0	Use information technology tools. – The student will be able to:
19.01	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.

19.02	Employ computer operations applications to access, create, manage, integrate, and store information.
19.03	Employ collaborative/groupware applications to facilitate group work.
20.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. – The student will be able to:
20.01	Describe the nature and types of business organizations.
20.02	Explain the effect of key organizational systems on performance and quality.
20.03	List and describe quality control systems and/or practices common to the workplace.
21.0	Describe the importance of professional ethics and legal responsibilities. – The student will be able to:
21.01	Evaluate and justify decisions based on ethical reasoning.
21.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
21.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
21.04	Interpret and explain written organizational policies and procedures.
21.05	Compare benefits and shortcomings of desktop, server, enterprise, and hosted (cloud) software applications.
21.06	Discuss trends in geospatial technology and applications.

**Course Number: GIS0091**  
**Occupational Completion Point: B**  
**GIS Technician – 300 Hours – SOC Code 15-1199**

22.0 Create surface models of spatial data to map distance. – The student will be able to:

22.01 Create a straight line distance calculation.

22.02 Create a cost weighted distance calculation based on multiple inputs (costs).

22.03 Analyze an allocation grid created from a distance analysis calculation.

23.0 Demonstrate density models of spatial data. – The student will be able to:

23.01 Identify different distance density calculation techniques.

23.02 Calculate density using both the kernel and simple calculation methods.

24.0 Demonstrate different surface interpolation methods. – The student will be able to:

24.01 Create a surface from a set of features using the Inverse Distance Weighted interpolation method.

24.02 Create a surface from a set of features using the Spline interpolation method.

25.0 Demonstrate different surface analysis methods. – The student will be able to:

25.01 Create elevation contour data from an elevation raster.

25.02 Calculate and display slope derived from an elevation raster.

25.03 Determine and display aspect from an elevation raster.

25.04 Create a hillshade surface from an elevation raster.

25.05 Calculate the viewshed of a surface to determine visible objects.

25.06 Calculate the cut/fill of a surface to estimate volume changes.

26.0 Use different statistical methods in raster analysis. – The student will be able to:

26.01 Calculate cell statistics using temporal raster grid data.

26.02 Calculate neighborhood statistics and zonal statistics using raster grid data.

27.0 Interpret different types of spatial data used in 3D visualization and analysis. – The student will be able to:

27.01	Navigate various types of surfaces.
27.02	Explore methods of obtaining, downloading, and extracting free data using the Internet.
27.03	Build 3D datasets.
27.04	Display 2D features onto a 3D surface.
27.05	Create shapefiles to view in a 3D environment.
27.06	Construct a 3D model of an urban environment.
27.07	Display georeferenced data measurements in 3D.
27.08	Apply Interpolation methods.
27.09	Utilize georeferenced 2D data in a 3D environment to provide valuable information.
27.10	Create contour lines in a 3D environment.
27.11	Search, select, and download public domain data and imagery from the Nation Elevation Dataset (NED).
28.0	Create network datasets using existing shapefiles and geodatabases. – The student will be able to:
28.01	Find the most efficient routes for multiple stops on a complex street network.
28.02	Generate directions from one location to another using a street network.
28.03	Find the closest facility from a location on a complex street network.
28.04	Define service areas using a street network based on travel time.
28.05	Create an Origin-Destination Cost Matrix to communicate costs associated with travel from facilities to destinations in a geospatial network.
28.06	Demonstrate modeling of real world traffic flow.
29.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. – The student will be able to:
29.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
29.02	Explain emergency procedures to follow in response to workplace accidents.
29.03	Create a disaster and/or emergency response plan.
30.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives – The student will be able to:

30.01	Employ leadership skills to accomplish organizational goals and objectives.
30.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
30.03	Conduct and participate in meetings to accomplish work tasks.
30.04	Employ mentoring skills to inspire and teach others.
31.0	Explain the importance of employability skill and entrepreneurship skills. – The student will be able to:
31.01	Identify and demonstrate positive work behaviors needed to be employable.
31.02	Develop personal career plan that includes goals, objectives, and strategies.
31.03	Examine licensing, certification, and industry credentialing requirements.
31.04	Maintain a career portfolio to document knowledge, skills, and experience.
31.05	Evaluate and compare employment opportunities that match career goals.
31.06	Identify and exhibit traits for retaining employment.
31.07	Identify opportunities and research requirements for career advancement.
31.08	Research the benefits of ongoing professional development.
31.09	Examine and describe entrepreneurship opportunities as a career planning option.
32.0	Create a 3D map using a GPS unit for use in a class wide project.
32.01	Demonstrate implementation of surface analysis, three dimension and networked data.
33.0	Create an extensive campus-based geospatial project. – The student will be able to:
33.01	Create a campus inventory.
33.02	Plan a complete geospatial project.
33.03	Implement a campus-based geospatial project.
33.04	Organize project into an effective report including map layouts.
33.05	Present project using a written and/or oral report.
34.0	Design an individual career plan that reflects the transition from school to work, lifelong learning, and personal and professional goals. – The student will be able to:

34.01	Research, compare, and contrast GIS technology careers (e.g., characteristics needed, skills required, education required, industry certifications, advantages and disadvantages of GIS technology careers, the need for GIS technology workers).
34.02	Describe the variety of occupations and professions within the world of GIS technology including those where information technology is either in a primary focus or in a supportive role.
34.03	Describe job requirements for the variety of occupations and professions within the global world of GIS technology.
34.04	Analyze personal skills and aptitudes in comparison with GIS technology career opportunities.
34.05	Refine and implement a plan to facilitate personal growth and skill development related to GIS technology career opportunities.
34.06	Develop and maintain an electronic career portfolio, to include, but not limited to the Resume and Letter of Application.



## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills (if applicable)**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed online.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Technology Support Services  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y100100
CIP Number	0515120200
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in computer technology support positions in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills.

The content includes but is not limited to practical experiences in the implementation, management, and maintenance of advanced technology user environments.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of one occupational completion point in the program.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0059	Technology Support Specialist	BUS ED 1 @2 COMPU SCI 6 INFO TECH 7G	600 hours	15-1151

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of computer systems.
- 02.0 Demonstrate knowledge of different operating systems.
- 03.0 Develop a familiarity with the information technology industry.
- 04.0 Develop an awareness of microprocessors and digital computers.
- 05.0 Develop an awareness of the different types of printers.
- 06.0 Develop an awareness of emerging technologies.
- 07.0 Demonstrate an understanding of the Open Systems Interface (OSI) model.
- 08.0 Identify computer components and their functions.
- 09.0 Demonstrate proficiency using the Internet to locate information.
- 10.0 Demonstrate proficiency using Hypertext Markup Language (HTML).
- 11.0 Demonstrate proficiency in webpage design.
- 12.0 Demonstrate proficiency using common software applications.
- 13.0 Perform email activities.
- 14.0 Demonstrate proficiency in using presentation software and equipment.
- 15.0 Perform decision-making activities in a multimedia environment.
- 16.0 Demonstrate proficiency with personal computer hardware.
- 17.0 Troubleshoot printers.
- 18.0 Demonstrate proficiency with installing and configuring client system hardware.
- 19.0 Demonstrate proficiency in troubleshooting, repair and maintenance of client systems.
- 20.0 Demonstrate proficiency with client operating systems and software.
- 21.0 Configure and perform system backup and recovery of a client system.
- 22.0 Configure a Virtual Hard Disk (VHD) on a client system.
- 23.0 Demonstrate proficiency with networking.
- 24.0 Demonstrate an understanding of fundamental computer security.
- 25.0 Demonstrate proficiency with installing, configuring, and upgrading common client software applications or suites.
- 26.0 Solve software installation escalations.
- 27.0 Solve software failure escalations.
- 28.0 Demonstrate proficiency with technical support operational procedures.
- 29.0 Describe the operation of data networks.
- 30.0 Differentiate between various network media and topologies.
- 31.0 Install and configure basic network devices.
- 32.0 Demonstrate proficiency using basic network tools.
- 33.0 Demonstrate an understanding of network IP addressing and associated issues.
- 34.0 Demonstrate an understanding of network management tasks and methodologies.
- 35.0 Implement a Wireless Local Area Network (WLAN).
- 36.0 Demonstrate an understanding of network security threats and mitigation techniques.
- 37.0 Demonstrate proficiency with troubleshooting network operating systems.
- 38.0 Configure Full Disk Encryption (FDE) software.

- 39.0 Identify basic cloud concepts.
- 40.0 Configure intranet tunneling software.
- 41.0 Demonstrate proficiency with cloud based technologies.
- 42.0 Demonstrate proficiency in configuring and maintaining remote connections.
- 43.0 Perform installation, configuration, and management operations for both client and server disks.
- 44.0 Monitor system performance.
- 45.0 Optimize system performance.
- 46.0 Demonstrate proficiency with troubleshooting specialized network and communications devices.
- 47.0 Configure and maintain network-based technologies associated with providing web services.

Florida Department of Education  
 Student Performance Standards

Program Title: Technology Support Services  
 Career Certificate Program Number: Y100100

<b>Course Number: CTS0059</b>	
<b>Occupational Completion Point: A</b>	
<b>Technology Support Specialist – 600 Hours – SOC Code 15-1151</b>	
01.0	Demonstrate knowledge, skill, and application of computer systems. – The student will be able to:
01.01	Describe and use current and emerging computer technology and software to perform personal and business related tasks.
01.02	Describe the types of communications and networking systems used in workplace environments.
01.03	Locate and use software application reference materials such as on-line help, vendor bulletin boards, tutorials, and manuals.
01.04	Troubleshoot problems with computer hardware peripherals.
01.05	Describe ethical, privacy, and security issues and problems associated with computers and information systems.
01.06	Demonstrate proficiency in using the basic features of GUI browsers.
02.0	Demonstrate knowledge of different operating systems. – The student will be able to:
02.01	Identify the most common computer operating systems.
02.02	Describe and use industry accepted file naming conventions, particularly in NTFS and FAT file systems.
02.03	Demonstrate proficiency with file management tasks.
02.04	Demonstrate a working knowledge of standard file formats.
02.05	Compare and contrast various operating systems.
02.06	Differentiate between different operating systems and applications.
02.07	Compare and contrast open source and proprietary software.
02.08	Explain how system utilities are used to maintain computer performance.
03.0	Develop a familiarity with the information technology industry. – The student will be able to:



03.01	Explain how information technology impacts the operation and management of business and society.
03.02	Identify and describe the various ways of segmenting the IT industry (e.g., hardware vs. software, server vs. client, business vs. entertainment, stable vs. mobile).
03.03	Describe how digital technologies (social media) are changing both work and personal lifestyles.
04.0	Develop an awareness of microprocessors and digital computers. – The student will be able to:
04.01	Describe the evolution of the digital computer.
04.02	Explain the general architecture of a microcomputer system.
04.03	Explain the evolution of microprocessors.
04.04	Explain software hierarchy and its impact on microprocessors.
04.05	Explain the need for and use of peripherals.
04.06	Demonstrate proficiency installing and using plug-and-play peripherals.
04.07	Identify the basic concepts of computer maintenance and upgrades.
05.0	Develop an awareness of the different types of printers. – The student will be able to:
05.01	Describe the different types.
05.02	Explain how drivers work with printers.
05.03	Demonstrate troubleshooting techniques to repair printers.
06.0	Develop an awareness of emerging technologies. – The student will be able to:
06.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
06.02	Describe social media as an emerging technology.
06.03	Adhere to published best practices for protecting personal identifiable information when using the Internet.
06.04	Identify trends related to the use of information technology in people's personal and professional lives.
06.05	Characterize how the rapid pace of change in information technology impacts our society.
07.0	Demonstrate an understanding of the Open Systems Interface (OSI) model. – The student will be able to:
07.01	Describe the evolution of OSI from its inception to the present and into the future.
07.02	Explain the interrelations of the seven layers of the Open Systems Interface (OSI) as it relates to hardware and software.

07.03	Describe the purpose of the OSI model and each of its layers.
07.04	Explain specific functions belonging to each OSI model layer.
07.05	Understand how two network nodes communicate through the OSI model.
07.06	Discuss the structure and purpose of data packets and frames.
07.07	Describe the two types of addressing covered by the OSI model.
08.0	Identify computer components and their functions. – The student will be able to:
08.01	Identify the internal components of a computer.
08.02	Use common computer and DOS commands terminology.
09.0	Demonstrate proficiency using the Internet to locate information. – The student will be able to:
09.01	Identify and describe web terminology.
09.02	Define Universal Resource Locators (URLs) and associated protocols.
09.03	Compare and contrast the types of Internet domains.
09.04	Describe and observe Internet/Intranet ethics and copyright laws and regulatory control.
09.05	Trace the evolution of the Internet from its inception to the present and into the future.
09.06	Demonstrate proficiency using search engines, including Boolean search strategies.
09.07	Demonstrate proficiency using various web tools.
09.08	Compare and contrast the roles of web servers and web browsers.
10.0	Demonstrate proficiency using Hypertext Markup Language (HTML). – The student will be able to:
10.01	Categorize websites according to their purpose.
10.02	Describe the types of documents that might be used in a web environment.
10.03	Identify elements of a webpage.
10.04	Define basic HTML terminology.
10.05	Critique the aesthetic and functional operation of sample websites.

10.06	Create storyboards depicting a multi-page website.
10.07	Design, edit, and test HTML documents for accuracy and validity.
10.08	Create and modify webpages using a Graphical User Interface (GUI) editor.
10.09	Enhance webpages through the addition of images and graphics including animation.
10.10	Analyze webpage source code developed by others.
10.11	Create webpages using basic HTML tags.
11.0	Demonstrate proficiency in webpage design. – The student will be able to:
11.01	Develop an awareness of acceptable webpage design, including index pages in relation to the rest of the website.
11.02	Describe and apply color theory as it applies to webpage design.
11.03	Access and digitize graphics through various resources.
11.04	Use image design software to create and edit images.
11.05	Demonstrate proficiency in publishing to the Internet.
11.06	Explain the need for web-based applications.
12.0	Demonstrate proficiency using common software applications. – The student will be able to:
12.01	Compare and contrast the appropriate use of various software applications.
12.02	Demonstrate proficiency in the use of various software applications.
13.0	Perform email activities. – The student will be able to:
13.01	Describe email capabilities and functions.
13.02	Identify components of an email message.
13.03	Identify the components of an email address.
13.04	Identify when to use different email options.
13.05	Attach a file to an email message.
13.06	Forward an email message.
13.07	Use an address book.

13.08	Create a private email group.
13.09	Reply to an email message.
13.10	Use the Internet to perform email activities.
13.11	Identify the appropriate use of email and demonstrate related email etiquette.
13.12	Identify when to include information from an original email message in a response.
13.13	Identify common problems associated with widespread use of email.
14.0	Demonstrate proficiency in using presentation software and equipment. – The student will be able to:
14.01	Produce a presentation that includes music, animation, and digital photography and present it using a projection system.
14.02	Using presentation software, create a multimedia presentation that incorporates shot and edited video, animation, music, narration and adheres to good design principles, use of transitions, and effective message conveyance.
14.03	Demonstrate knowledge of the roles and responsibilities of a multimedia production team.
14.04	Collaborate with team members to plan, edit, evaluate, and present a multimedia presentation where individuals on the team function in specific production roles.
14.05	Create a self-running presentation with synchronized audio, convert presentation slides into streaming ASF files for use on the web.
15.0	Perform decision-making activities in a multimedia environment. – The student will be able to:
15.01	Determine work priorities, the audience, project budgets, project specifications, and the production schedule.
15.02	Evaluate and select appropriate software packages and multimedia tools to complete assigned tasks.
15.03	Present and defend design projects.
15.04	Evaluate criteria for selecting an operating system.
16.0	Demonstrate proficiency with personal computer hardware. – The student will be able to:
16.01	Categorize storage devices and backup media.
16.02	Explain motherboard components, types and features.
16.03	Classify power supplies types and characteristics.
16.04	Explain the purpose and characteristics of CPUs and their features.
16.05	Explain cooling methods and devices.
16.06	Compare and contrast memory types, characteristics and their purpose.
16.07	Distinguish between the different display devices and their characteristics.

16.08	Summarize the function and types of adapter cards.
17.0	Troubleshoot printers. – The student will be able to:
17.01	Demonstrate proficiency with device drivers.
17.02	Troubleshoot common hardware errors.
18.0	Demonstrate proficiency with installing and configuring client system hardware. – The student will be able to:
18.01	Install, configure and optimize personal computer components.
18.02	Install, configure, and optimize laptop components.
18.03	Install, configure, and optimize client system peripherals.
18.04	Demonstrate proficiency using the following tools:
18.04.1	Multimeter.
18.04.2	Power supply tester.
18.04.3	Cable testers.
18.04.4	Loop back plugs.
18.04.5	Anti-static pad and wrist strap.
18.04.6	Extension magnet.
19.0	Demonstrate proficiency in troubleshooting, repairing and maintaining of client systems. – The student will be able to:
19.01	Explain the troubleshooting theory.
19.02	Explain and interpret common hardware and operating system symptoms and their causes.
19.03	Determine the troubleshooting methods and tools for printers.
19.04	Explain and interpret common mobile device issues and determine the appropriate basic troubleshooting method.
19.05	Integrate common preventative maintenance techniques.
19.06	Analyze system/application logs and other system resources to identify and/or resolve performance issues related to display, disk space, and virtual memory.
19.07	Use appropriate client system tools and utilities to diagnose and resolve hardware failure issues, including hard drive sectors, memory, cabling, and BIOS.
20.0	Demonstrate proficiency with client operating systems and software. – The student will be able to:

20.01	Compare and contrast the different client operating systems and their features.
20.02	Explain the process and steps to install and configure a client operating system.
20.03	Explain the basics of boot sequences, methods and startup utilities.
20.04	Perform a clean installation of an operating system.
20.05	Perform a version upgrade to an existing operating system, maintaining user profiles, preferences, and historical information.
21.0	Configure and perform a system backup and recovery of a client system. – The student will be able to:
21.01	Compare and contrast system backup and system imaging.
21.02	Create a system image file or backup file as appropriate.
21.03	Create system restore points.
21.04	Configure system images and backup files for automatic update.
21.05	Recover a system using either a system image file or backup file.
22.0	Configure a Virtual Hard Disk (VHD) on a client system. – The student will be able to:
22.01	Create, deploy, boot, mount, and update a VHD.
22.02	Perform offline updates.
22.03	Perform offline servicing.
23.0	Demonstrate proficiency with networking. – The student will be able to:
23.01	Summarize the basics of networking fundamentals, including technologies, devices and protocols.
23.02	Categorize network cables by function, speed, and connectors.
23.03	Compare and contrast the different network types.
23.04	Validate client configuration for network connectivity.
23.05	Install and configure connectivity for a small local area network using either IPv4 or IPv6.
23.06	Set up user accounts for a small local area network.
23.07	Configure file and folder access using NTFS permissions and sharing.
24.0	Demonstrate an understanding of fundamental computer security. – The student will be able to:
24.01	Explain basic security concepts and technologies, including firewalls, encryption technologies, and authentication.

24.02	Describe the following security and authentication features and technologies:
24.02.1	Advantages and disadvantages of specific wireless security types; keys; SSID; MAC filters.
24.02.2	Malicious software protection.
24.02.3	BIOS Security.
24.02.4	Password complexity.
24.02.5	Locking workstation.
24.02.6	Biometrics and physical authentication.
24.03	Discuss the basics of data sensitivity and security, including compliance, classifications, and social engineering.
24.04	Install, configure, and launch antivirus software, isolating or removing viruses and malware as needed.
24.05	Configure a local security policy and associated authentication and authorization rules.
25.0	Demonstrate proficiency with installing, configuring, and upgrading common client software applications or suites. – The student will be able to:
25.01	Validate software licensing compliance and system compatibility.
25.02	Perform initial installation of a common software application.
25.03	Perform an upgrade of a common software application.
25.04	Set default Internet browser.
25.05	Install software and/or browser add-ins.
26.0	Solve software installation escalations. – The student will be able to:
26.01	Verify installation permissions.
26.02	Validate local administrator requirement.
26.03	Determine licensing restrictions.
26.04	Validate digital signing.
27.0	Solve software failure escalations. – The student will be able to:
27.01	Check the appropriate OS troubleshooting utilities.
27.02	Check whether the application runs in Safe mode.

27.03	Isolate the problem and repair the installation.
27.04	Check recently added programs.
27.05	Restore or reimage the system.
28.0	Demonstrate proficiency with technical support operational procedures. – The student will be able to:
28.01	Adhere to safety and environmental procedures related to ESD, SMI, RFI, electrical safety, cabling, and physical/environmental.
28.02	Describe the characteristics desired in establishing and maintaining good customer relations.
28.03	Demonstrate appropriate communication skills and professionalism in customer interactions.
28.04	Apply call center vocabulary.
29.0	Describe the operation of data networks. – The student will be able to:
29.01	Explain the function of common networking protocols.
29.02	Identify commonly used TCP and UDP default ports.
29.03	Identify IP address formats.
29.04	Identify the proper use of IP addressing technologies and addressing schemes.
29.05	Identify common IPv4 and IPv6 routing protocols.
29.06	Explain the purpose and properties of routing.
29.07	Compare the characteristics of wireless communication standards.
29.08	Interpret network diagrams.
30.0	Differentiate between various network media and topologies. – The student will be able to:
30.01	Categorize standard cable types and their properties.
30.02	Identify common connector types.
30.03	Identify common physical network topologies.
30.04	Differentiate and implement appropriate wiring standards.
30.05	Select the appropriate media, cables, ports, and connectors to connect network devices.
30.06	Categorize WAN technology types and properties.



30.07	Categorize LAN technology types and properties.
30.08	Explain common logical network topologies and their characteristics.
30.09	Install components of wiring distribution.
31.0	Install and configure basic network devices. – The student will be able to:
31.01	Install, configure and differentiate between common network devices.
31.02	Identify the functions of specialized network devices.
31.03	Explain the advanced features of a switch.
31.04	Implement a small switched network, including remote access management.
31.05	Verify network status and operation using basic utilities (e.g., ping, traceroute, telnet, SSH, arp, ipconfig).
31.06	Implement a basic wireless network.
32.0	Demonstrate proficiency using basic network tools. – The student will be able to:
32.01	Select the appropriate command line interface tool and interpret the output to verify functionality.
32.02	Explain the purpose of network scanners.
32.03	Utilize the appropriate hardware tools.
33.0	Demonstrate an understanding of network IP addressing and associated issues. – The student will be able to:
33.01	Assign and verify valid IP addresses in a LAN environment.
33.02	Describe Network Address Translation (NAT) and its role in network communication.
33.03	Distinguish between public and private IP addresses.
33.04	Explain the operation of DHCP and DNS services and their impact on network client systems.
33.05	Detect and correct IP addressing issues.
34.0	Demonstrate an understanding of network management tasks and methodologies. – The student will be able to:
34.01	Explain the function of each layer of the OSI model.
34.02	Identify types of configuration management documentation.
34.03	Evaluate the network based on configuration management documentation.

34.04	Explain network segmentation and traffic management concepts.
34.05	Conduct network monitoring to identify performance and connectivity issues.
34.06	Explain different methods and rationales for network performance optimization.
34.07	Configure updates to a network operating system to include manual, automatic, and rollback aspects.
34.08	Implement network troubleshooting methodologies.
34.09	Troubleshoot common connectivity issues and select an appropriate solution.
35.0	Implement a Wireless Local Area Network (WLAN). – The student will be able to:
35.01	Describe the standards associated with wireless media.
35.02	Identify and describe the purpose of the components of a small WLAN.
35.03	Configure a small WLAN such that devices connect to the correct access point.
35.04	Describe the security features and capabilities of WI-FI Protected Access (WPA).
35.05	Describe common issues with implementing a WLAN and methods for addressing these issues.
36.0	Demonstrate an understanding of network security threats and mitigation techniques. – The student will be able to:
36.01	Explain the function of hardware and software security devices.
36.02	Explain common features of a firewall.
36.03	Explain the methods of network access security.
36.04	Explain methods of user authentication.
36.05	Explain issues that affect device security.
36.06	Implement password and physical security in a small routed network.
36.07	Identify common security threats and mitigation techniques.
37.0	Demonstrate proficiency with troubleshooting server based operating systems. – The student will be able to:
37.01	Select the appropriate commands and options to troubleshoot and resolve problems.

37.02	Select and use system utilities/tools appropriate to a problem and evaluate the results.
37.03	Evaluate and resolve common issues.
38.0	Configure Full Disk Encryption (FDE) software (e.g., BitLocker, BitLocker To Go). – The student will be able to:
38.01	Describe disk encryption and its role and benefits in computer system security.
38.02	Compare and contrast disk encryption with file system encryption.
38.03	Configure system policies to accommodate full disk encryption.
38.04	Explain the role of the Trusted Platform Module (TPM) relative to computer system identification and security.
38.05	Manage TPM startup keys.
38.06	Configure startup key storage.
38.07	Describe a Data Recovery Agent (DRA) and its role in system security.
38.08	Configure a DRA on a client and network server.
38.09	Perform data and system recovery operations.
39.0	Identify basic cloud concepts. – The student will be able to:
39.01	Understand the distinction between SaaS, IaaS and PaaS.
39.02	Distinguish between cloud deployment models.
39.03	Understand cloud computing characteristics.
40.0	Configure intranet tunneling software. – The student will be able to:
40.01	Describe Internet Protocol Security (IPSec) and its role in secure tunnel connectivity.
40.02	Compare and contrast the characteristics and operation of an infrastructure tunnel and an intranet tunnel.
40.03	Configure endpoints required for an intranet tunnel connection.
40.04	Configure system and user authentication for an intranet tunnel connection.
40.05	Define the requirements for establishing a network infrastructure tunnel.

40.06	Resolve tunnel connectivity issues.
41.0	Demonstrate proficiency with cloud based technologies. – The student will be able to:
41.01	Describe cloud based technologies and their unique challenges.
41.02	Map network drives.
41.03	Configure offline file policies for synchronized access to network shared files.
41.04	Describe transparent caching and explain its role in optimizing network performance, particularly mobile networks.
41.05	Describe Power over Ethernet (PoE) and its role in creating a power management schema.
42.0	Demonstrate proficiency in configuring and maintaining remote connections. – The student will be able to:
42.01	Establish a Virtual Private Network (VPN) connection with authentication.
42.02	Enabling a VPN reconnect to accommodate mobile remote users.
42.03	Perform a Strength, Weakness, Opportunity, and Threat (SWOT) analysis of a local area network configured for remote access connectivity.
42.04	Describe Network Access Protection (NAP) and its role in ensuring health and compliance of connected devices.
42.05	Compare and contrast the use of quarantine and captive portals to accomplish remediation of connected devices.
42.06	Configure NAP for wireless remote connections.
42.07	Configure dial-up connections.
42.08	Enable and configure remote desktop in both client and server environments.
43.0	Perform installation, configuration, and management operations for both client and server disks. – The student will be able to:
43.01	Install, initialize, and partition a hard drive.
43.02	Describe file system fragmentation and its impact on system performance.
43.03	Perform a file system defragmentation.
43.04	Describe Redundant Array of Independent Disks (RAID) configuration.
43.05	Configure removable device policies.

44.0	Monitor system performance. – The student will be able to:
44.01	Configuring event logging.
44.02	Filtering event logs.
44.03	Event subscriptions.
44.04	Data collector sets.
44.05	Generating a system diagnostics report.
45.0	Optimize system performance. – The student will be able to:
45.01	Update device drivers.
45.02	Configure a Network Interface Card (NIC) for full duplex operation.
45.03	Create a power plan (scheme) for optimum power/energy efficiency.
45.04	Configure performance settings under Advanced System Properties.
45.05	Configure desktop settings and user profiles.
45.06	Configure services and programs to resolve performance issues.
45.07	Resolve mobile computing performance issues.
46.0	Demonstrate proficiency with troubleshooting specialized network and communications devices. – The student will be able to:
46.01	Select the appropriate commands and options to troubleshoot and resolve problems with network devices.
46.02	Select and use system utilities/tools appropriate to a problem and evaluate the results.
46.03	Evaluate and resolve common issues related to network connectivity, security, and performance of connected devices.
47.0	Configure and maintain network-based technologies associated with providing web services. – The student will be able to:
47.01	Configure and maintain a web server, to include setting up authentication, security certificates, and permissions for Active Server Page operation.
47.02	Connect to a File Transfer Protocol (FTP) server, to include setting up access and permissions.
47.03	Connect to mail transfer protocol server.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Computer Systems & Information Technology (CSIT)  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y100200
CIP Number	0511090107
Grade Level	30, 31
Standard Length	900 hours
Teacher Certification	Refer to the <b>Program Structure</b> section.
CTSO	Phi Beta Lambda BPA SkillsUSA
SOC Codes (all applicable)	15-1152 – Computer Network Support Specialists 15-1142 – Network and Computer Systems Administrators 15-1122 – Information Security Analysts
Basic Skills Level	Mathematics: 10 Language: 9 Reading: 9

**Purpose**

The purpose of this program is to prepare students for employment or advanced training in a variety of occupations in the information technology industry.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the information technology industry; technical and product skills, underlying principles of technology , planning, management, finance, labor issues, community issues and health, safety, and environmental issues.

The content includes but is not limited to communication, leadership skills, human relations and employability skills; and safe, efficient work practices.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.



## Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points. When the recommended sequence is followed, the structure is intended to prepare students to complete the CompTIA A+, Network+, and Security+ industry certifications. Sufficient coverage of advanced networking concepts and competencies may also lead to Cisco's CCENT and CCNA industry certifications. A student who completes the applicable competencies at any occupational completion point may either continue with the training or become an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0082	Computer Systems Technician	BUS ED 1 @2 COMPU SCI 6 COMP SVC 7G INFO TECH 7 G CYBER TECH 7 G ELECTRONIC @7 7 G	300 hours	15-1152
B	CTS0083	Computer Network Technician		150 hours	15-1142
C	CTS0084	Computer Networking Specialist		150 hours	15-1142
D	CTS0069	Computer Security Technician		300 hours	15-1122

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate proficiency with personal computer hardware.
- 02.0 Apply troubleshooting, repairing and maintenance techniques.
- 03.0 Understand operating systems and software.
- 04.0 Identify and construct a basic network.
- 05.0 Analyze and react to various security threats and vulnerabilities.
- 06.0 Explain the basic physical security elements of a network.
- 07.0 Demonstrate proficiency with operational procedure.
- 08.0 Demonstrate language arts knowledge and skills.
- 09.0 Demonstrate mathematics knowledge and skills.
- 10.0 Demonstrate proficiency with installing, configuring, and troubleshooting personal computer hardware.
- 11.0 Apply techniques to various operating systems.
- 12.0 Build, secure and troubleshoot medium to large.
- 13.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 14.0 Solve problems using critical thinking skills, creating and innovation.
- 15.0 Use information technology tools.
- 16.0 Describe the roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment.
- 17.0 Describe the importance of professional ethics and legal responsibilities.
- 18.0 Describe the operation of data networks.
- 19.0 Verify connectivity between two end devices.
- 20.0 Configure a Layer 3 switch.
- 21.0 Program a router with basic configurations
- 22.0 Explain how IPv6 address assignments are implemented in a business network.
- 23.0 Explain how data is moved across the network, from opening an application, to receiving data.
- 24.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 25.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 26.0 Explain the importance of employability skill and entrepreneurship skills.
- 27.0 Describe a switched network a small-to-medium-sized business.
- 28.0 Describe a routing environment.
- 29.0 Explore the concept of switches and security.
- 30.0 Configure and troubleshoot a Layer 3 environment.
- 31.0 Configure, troubleshoot and implement ACLs.
- 32.0 Demonstrate knowledge of how network services and protocols interact to provide network communication in order to securely implement and use common protocols.
- 33.0 Demonstrate an understanding of cybersecurity concepts and research.
- 34.0 Recognize attacks and apply appropriate solutions.
- 35.0 Recognize and be able to differentiate and explain the following access control models.
- 36.0 Comprehend and develop an understanding of protocol security and associated risks.

- 37.0 Recognize and understand remote access technologies.
- 38.0 Identify and administer security fixes as defined by the appropriate OSI layers.
- 39.0 Recognize and understand the administration of the following directory security concepts.
- 40.0 Identify-wireless technologies, concepts and vulnerabilities.
- 41.0 Apply advanced principles of security techniques.
- 42.0 Define concepts of Key Management and Certificate Lifecycles.
- 43.0 Understand the application of the following concepts of physical security.
- 44.0 Understand security concerns for types of network topologies and media.
- 45.0 Implement the process of network system hardening within a computer network.
- 46.0 Describe the security implications of the following topics of disaster recovery options.
- 47.0 Demonstrate proficiency in applying the concepts and uses of the following types of policies and procedures.
- 48.0 Understand different types of privilege management.
- 49.0 Understand the concepts of cybersecurity guidelines.
- 50.0 Understand training of end users, executives and human resources in security vulnerabilities.

Florida Department of Education  
Student Performance Standards

Program Title: Computer Systems & Information Technology  
Career Certificate Program Number: Y100200

<b>Course Number: CTS0082</b>	
<b>Occupational Completion Point: A</b>	
<b>Computer Systems Technician – 300 Hours – SOC Code 15-1152</b>	
01.0	Demonstrate proficiency with personal computer hardware. – The student will be able to:
01.01	Categorize storage devices and backup media.
01.02	Explain motherboard components, types and features.
01.03	Classify power supplies types and characteristics.
01.04	Explain the purpose and characteristics of CPUs and their features.
01.05	Explain cooling methods and devices.
01.06	Compare and contrast memory types, characteristics and their purpose.
01.07	Distinguish between the different display devices and their characteristics.
01.08	Install and configure peripherals and input devices.
01.09	Summarize the function and types of adapter cards.
01.10	Install, configure and optimize laptop components and features.
01.11	Install and configure printers.
01.12	Explain advantages of using PCIe adapter cards.
01.13	Configure tablets and mobile phones.
01.14	Configure network printers using a static IP address.
02.0	Apply troubleshooting, repairing and maintenance techniques. – The student will be able to:
02.01	Explain the troubleshooting theory.
02.02	Explain and interpret common hardware and operating system symptoms and their causes.

02.03	Explain and interpret common operating system symptoms and their causes.
02.04	Determine the troubleshooting methods and tools for printers.
02.05	Explain and interpret common laptop issues and determine the appropriate basic troubleshooting method.
02.06	Integrate common preventative maintenance techniques.
02.07	Explain and interpret common software symptoms and their causes.
03.0	Understand operating systems and software. – The student will be able to:
03.01	Compare and contrast the different Windows Operating Systems from Windows 7 up and their features.
03.02	Explain the difference in features of the various Windows versions from Windows 7 through Windows 10.
03.03	Explain the process and steps to install and configure the Windows OS.
03.04	Explain the basics of boot sequences, methods and startup utilities, including msconfig.
04.0	Identify and construct a basic network. – The student will be able to:
04.01	Summarize the basics of networking fundamentals, including technologies and devices.
04.02	Summarize the basics of networking fundamentals, including technologies and protocols.
04.03	Categorize network cables and connectors and their implementations.
04.04	Compare and contrast the different network types include SOHO networks.
05.0	Analyze and react to various security threats and vulnerabilities. – The student will be able to:
05.01	Explain the basic principles of security concepts and technologies (physical, software, social engineering).
05.02	Explain and define security features.
06.0	Explain the basic physical security elements of a network. – The student will be able to:
06.01	Explain the basic software security elements of a network, including firewalls, IDS and IPS.
06.02	Explain how the human element plays a major role in network security, including social engineering.
07.0	Demonstrate proficiency with operational procedure. – The student will be able to:
07.01	Outline the purpose of appropriate safety and environmental procedures and given a scenario apply them.
07.02	Given a problem, demonstrate communication and technical skills to escalate the problem for a solution.
07.03	Explain chain of custody for various scenarios.

08.0	Demonstrate language arts knowledge and skills. – The student will be able to:
08.01	Locate, comprehend and evaluate key elements of oral and written information.
08.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
08.03	Present information formally and informally for specific purposes and audiences.
09.0	Demonstrate mathematics knowledge and skills. – The student will be able to:
09.01	Demonstrate knowledge of arithmetic operations.
09.02	Analyze and apply data and measurements to solve problems and interpret documents.
09.03	Construct charts/tables/graphs using functions and data.
10.0	Demonstrate proficiency with installing, configuring, and troubleshooting personal computer hardware. – The student will be able to:
10.01	Install, configure and maintain personal computer components.
10.02	Detect problems, troubleshoot and repair/replace personal computer components.
10.03	Install, configure, detect problems, troubleshoot and repair/replace laptop components.
10.04	Explain and demonstrate the use of computer tools.
11.0	Apply techniques to various operating systems. – The student will be able to:
11.01	Select the appropriate commands and options to troubleshoot and resolve problems.
11.02	Differentiate between Operating System file structures.
11.03	Given a scenario, select and use system utilities/tools and evaluate the results.
11.04	Evaluate and resolve common issues.
12.0	Build, secure and troubleshoot medium to large. – The student will be able to:
12.01	Troubleshoot client-side connectivity issues using appropriate tools.
12.02	Install and configure a small office home office (SOHO) network.
12.03	Given a scenario, prevent, troubleshoot and remove viruses and malware.
12.04	Implement security and troubleshoot common issues.
13.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
13.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the

	workplace.
13.02	Locate, organize and reference written information from various sources.
13.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
13.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
13.05	Apply active listening skills to obtain and clarify information.
13.06	Develop and interpret tables and charts to support written and oral communications.
13.07	Exhibit public relations skills that aid in achieving customer satisfaction.
14.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
14.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
14.02	Employ critical thinking and interpersonal skills to resolve conflicts.
14.03	Identify and document workplace performance goals and monitor progress toward those goals.
14.04	Conduct technical research to gather information necessary for decision-making.
15.0	Use information technology tools. – The student will be able to:
15.01	Use personal information management (PIM) applications to increase workplace efficiency.
15.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
15.03	Employ computer operations applications to access, create, manage, integrate, and store information.
15.04	Employ collaborative/groupware applications to facilitate group work.
16.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. – The student will be able to:
16.01	Describe the nature and types of business organizations.
16.02	Explain the effect of key organizational systems on performance and quality.
16.03	List and describe quality control systems and/or practices common to the workplace.
16.04	Explain the impact of the global economy on business organizations.
17.0	Describe the importance of professional ethics and legal responsibilities. – The student will be able to:
17.01	Evaluate and justify decisions based on ethical reasoning.



17.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
17.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
17.04	Interpret and explain written organizational policies and procedures.
17.05	Explain various types of software licensing.

**Course Number: CTS0083**  
**Occupational Completion Point: B**  
**Computer Network Technician – 150 Hours – SOC Code 15-1142**

18.0 Describe the operation of data networks. – The student will be able to:

18.01 Explain how multiple networks are used in everyday life.

18.02 Explain the topologies and devices used in a small-to-medium-sized business network.

18.03 Explain the basic characteristics of a network that supports communication in a small-to-medium-sized business.

18.04 Explain trends in networking that will affect the use of networks in small-to-medium-sized businesses.

18.05 Explain the purpose of the IOS.

18.06 Explain how to access and navigate the IOS to configure network devices.

18.07 Describe the command structure of the IOS software.

18.08 Configure hostnames on an IOS device using the CLI.

18.09 Use IOS commands to limit access to device configurations.

18.10 Use IOS commands to save the running configuration.

18.11 Explain how devices communicate across network media.

18.12 Configure a host device with an IP address.

19.0 Verify connectivity between two end devices. – The student will be able to:

19.01 Explain how rules are used to facilitate communication.

19.02 Explain the role of protocols and standards organizations in facilitating interoperability in network communications.

19.03 Explain how devices on a LAN access resources in a small to medium-sized business network.

19.04 Identify device connectivity options.

19.05 Describe the purpose and functions of the physical layer in the network.

19.06 Describe basic principles of the physical layer standards.

19.07 Identify the basic characteristics of network cables and connector types.

19.08 Build and terminate UTP cable used in Ethernet networks.

19.09	Describe, build and terminate fiber-optic cabling and its main advantages over other media.
19.10	Describe wireless media.
19.11	Select the appropriate media for a given requirement and connect devices.
19.12	Describe the operation of the Ethernet sub layers.
19.13	Identify the major fields of the Ethernet frame.
19.14	Describe the purpose and characteristics of the Ethernet MAC address.
19.15	Describe the purpose of ARP.
19.16	Explain how ARP requests impact network and host performance.
19.17	Explain basic switching concepts.
19.18	Compare fixed configuration and modular switches.
20.0	Configure a Layer 3 switch. – The student will be able to:
20.01	Explain how network layer protocols and services support communications across data networks.
20.02	Explain how routers enable end-to-end connectivity in a small to medium-sized business network.
20.03	Determine the appropriate device to route traffic in a small to medium-sized business network.
21.0	Program a router with basic configurations. – The student will be able to:
21.01	Describe the purpose of the transport layer in managing the transportation of data in end-to-end communication.
21.02	Describe characteristics of the TCP and UDP protocols, including port numbers and their uses.
21.03	Explain how TCP session establishment and termination processes facilitate reliable communication.
21.04	Explain how TCP protocol data units are transmitted and acknowledged to guarantee delivery.
21.05	Explain the UDP client processes to establish communication with a server.
21.06	Determine whether high-reliability TCP transmissions, or non-guaranteed UDP transmissions, are best suited for common applications.
21.07	Describe the structure of an IPv4 address.
21.08	Describe the purpose of the subnet mask.
21.09	Compare the characteristics and uses of the unicast, broadcast, and multicast IPv4 addresses.

21.10	Compare the use of public address space and private address space.
21.11	Explain the need for IPv6 addressing.
21.12	Describe the representation of an IPv6 address.
21.13	Describe types of IPv6 network addresses.
21.14	Configure global unicast addresses.
21.15	Describe multicast addresses.
21.16	Describe the role of ICMP in an IP network. (Include IPv4 and IPv6).
21.17	Use ping and trace route utilities to test network connectivity.
21.18	Explain why routing is necessary for hosts on different networks to communicate.
21.19	Describe IP as a communication protocol used to identify a single device on a network.
21.20	Given a network and a subnet mask, calculate the number of host addresses available.
21.21	Calculate the necessary subnet mask in order to accommodate the requirements of a network.
21.22	Describe the benefits of variable length subnet masking (VLSM).
22.0	Explain how IPv6 address assignments are implemented in a business network. – The student will be able to:
22.01	Explain how the functions of the application layer, session layer, and presentation layer work together to provide network services to end user applications.
22.02	Describe how common application layer protocols interact with end user applications.
22.03	Describe, at a high level, common application layer protocols that provide Internet services to end-users, including WWW services and email.
22.04	Describe application layer protocols that provide IP addressing services.
22.05	Describe the features and operation of well-known application layer protocols that allow for file sharing services.
23.0	Explain how data is moved across the network, from opening an application, to receiving data. – The student will be able to:
23.01	Identify the devices and protocols used in a small network.
23.02	Explain how a small network serves as the basis of larger networks.
23.03	Describe the need for basic security measures on network devices.
23.04	Identify security vulnerabilities and general mitigation techniques.

	23.05	Configure network devices with device hardening features to mitigate security threats.
	23.06	Use the output of ping and trace commands to establish relative network performance.
24.0		Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. – The student will be able to:
	24.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
	24.02	Explain emergency procedures to follow in response to workplace accidents.
	24.03	Create a disaster and/or emergency response plan.
25.0		Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. – The student will be able to:
	25.01	Employ leadership skills to accomplish organizational goals and objectives.
	25.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
	25.03	Conduct and participate in meetings to accomplish work tasks.
	25.04	Employ mentoring skills to inspire and teach others.
26.0		Explain the importance of employability skill and entrepreneurship skills. – The student will be able to:
	26.01	Identify and demonstrate positive work behaviors needed to be employable.
	26.02	Develop personal career plan that includes goals, objectives, and strategies.
	26.03	Examine licensing, certification, and industry credentialing requirements.
	26.04	Maintain a career portfolio to document knowledge, skills, and experience.
	26.05	Evaluate and compare employment opportunities that match career goals.
	26.06	Identify and exhibit traits for retaining employment.
	26.07	Identify opportunities and research requirements for career advancement.
	26.08	Research the benefits of ongoing professional development.
	26.09	Examine and describe entrepreneurship opportunities as a career planning option.

**Course Number: CTS0084**  
**Occupational Completion Point: C**  
**Computer Networking Specialist – 150 Hours – SOC Code 15-1142**

27.0 Describe a switched network a small-to-medium-sized business. – The student will be able to:

27.01 Describe convergence of data, voice, and video in the context of switched networks.

27.02 Setup and configure a switched environment.

27.03 Troubleshoot and diagnose a switched environment.

28.0 Describe a routing environment. – The student will be able to:

28.01 Configure a router to route between multiple directly connected networks.

28.02 Describe the primary functions and features of a router.

28.03 Explain how routers use information in data packets to make forwarding decisions in a small-to medium-sized business network.

28.04 Describe configure and troubleshoot VLAN routing environment.

29.0 Explore the concept of switches and security. – The student will be able to:

29.01 Explain the advantages and disadvantages of static routing.

29.02 Configure switch ports and security.

29.03 Describe security best practices in a switch environment.

29.04 Explain, configure and troubleshoot VLAN in a switch network.

30.0 Configure and troubleshoot a Layer 3 environment. – The student will be able to:

30.01 Explain the advantages and disadvantages of Layer 3 ~~of static~~ routing.

30.02 Define, compare and configure the different categories of routing protocols

31.0 Configure, troubleshoot and implement ACLs. – The student will be able to:

31.01 Explain, configure and modify ACL's

31.02 Apply ACLs to filter traffic.

32.0 Demonstrate knowledge of how network services and protocols interact to provide network communication in order to securely implement and use common protocols. – The student will be able to:

32.01 Describe and configure protocols (i.e., SMTP, TCP-IP, MAC, DNS, FTP and DHCP).

32.02 Identify commonly used default network ports.

32.03 Troubleshoot configure protocols within a switched network.

**Course Number: CTS0069**  
**Occupational Completion Point: D**  
**Computer Security Technician – 300 Hours – SOC Code 15-1122**

33.0	Demonstrate an understanding of cybersecurity concepts and research. – The student will be able to:
33.01	Describe the history of cybersecurity, including the evolution of a hacker culture.
33.02	Discuss the trends and national initiatives related to cybersecurity.
33.03	Distinguish between information assurance and cybersecurity.
33.04	Describe the concepts of confidentiality as it relates to user and data impact.
33.05	Explain authentication and the concept of non-repudiation.
34.0	Recognize attacks and apply appropriate solutions. – The student will be able to:
34.01	Recognize and define network susceptibilities and attacks. (i.e., DOS/DDOS (Denial of Service/Distributed Denial of Service)).
34.02	Recognize and define Password Guessing (e.g., Brute Force, Dictionary).
34.03	Recognize and define Software Exploitation.
34.04	Define email vulnerabilities apply appropriate security measures.
35.0	Recognize and be able to differentiate and explain the following access control models. – The student will be able to:
35.01	Recognize and define MAC (Mandatory Access Control).
35.02	Recognize and define DAC (Discretionary Access Control).
35.03	Recognize and define RBAC (Role Based Access Control).
36.0	Comprehend and develop an understanding of protocol security and associated risks. – The student will be able to:
36.01	Identify non-essential services and protocols running on hosts and network devices and know what actions to take to reduce the risks of those services and protocols.
36.02	Understand the concept of and know how reduce the risks of social engineering.
36.03	Understand the concept and significance of auditing, logging and system scanning.
36.04	Identify and be able to differentiate different cryptographic standards and protocols.
37.0	Recognize and understand remote access technologies. – The student will be able to:
37.01	Recognize and define 802.1x.



37.02	Recognize and define RADIUS (Remote Authentication Dial-In User Service).
37.03	Recognize and define TACACS (Terminal Access Controller Access Control System) and TACTCs+.
37.04	Recognize and define L2TP/PPTP (Layer Two Tunneling Protocol/Point to Point Tunneling Protocol).
37.05	Recognize and define SSH (Secure Shell).
37.06	Recognize and define IPSEC (Internet Protocol Security).
38.0	Identify and administer security fixes as defined by the appropriate OSI layers. – The student will be able to:
38.01	Recognize and define SSL/TLS (Secure Sockets Layer/Transport Layer Security).
38.02	Recognize and define LDAP (Lightweight Directory Access Protocol).
39.0	Recognize and understand the administration of the following directory security concepts. – The student will be able to:
39.01	Identify the different types of application layer protocol (POP3, SMTP, DNS and FTP).
39.02	Recognize and define File Sharing.
39.03	Recognize and define Vulnerabilities (i.e., packet sniffing, naming conventions).
40.0	Identify-wireless technologies, concepts and vulnerabilities. – The student will be able to:
40.01	Recognize and define WTLS (Wireless Transport Layer Security).
40.02	Differentiate Wi-Fi threats.
40.03	Apply encryption protocols for wireless networks.
41.0	Apply advanced principles of security techniques. – The student will be able to:
41.01	Compare and contrast Host and Network Based security techniques.
41.02	Be able to identify and explain cryptographic algorithms
41.03	Understand how cryptography and digital signatures address the following security concepts.
41.04	Identify authentication tools (e.g. PKI Public Key Infrastructure, Certificates, Renovation and Trust Models).
42.0	Define concepts of Key Management and Certificate Lifecycles. – The student will be able to:
42.01	Identify various security CA requirements.
42.02	Understand Hardware versus software key storage, Private key storage, Escrow, Expiration, Revocation, Renewal, Destruction, Key Usage, Multiple Key Pairs.

42.03	Create key management and procedures.
43.0	Understand the application of the following concepts of physical security. – The student will be able to:
43.01	Define Access Control (e.g., physical barriers, biometrics).
43.02	Define Social Engineering.
43.03	Defines issues related to Environment (e.g., wireless cells, location, shielding, fire suppression).
44.0	Understand security concerns for types of network topologies and media. – The student will be able to:
44.01	Recognize, define, and configure network hardware, appliances and handheld devices.
44.02	Define, and configure Network Monitoring/Diagnostics tools.
44.03	Understand the security concerns for the following types of media.
45.0	Implement the process of network system hardening within a computer network. – The student will be able to:
45.01	Install and configure Updates (Firmware & Software).
45.02	Install and configure Operating System and ACL's.
45.03	Enable and Disable Services and Protocols.
45.04	Setup and configure a server hardening within a computer network.
46.0	Describe the security implications of the following topics of disaster recovery options and utilities. – The student will be able to:
46.01	Define and use Backups Secure Recovery, Recovery Plan and Alternative sites. (On-site versus off-site storage).
46.02	Recognize and define Backup Utilities and High Availability/Fault Tolerance.
47.0	Demonstrate proficiency in applying the concepts and uses of the following types of policies and procedures. – The student will be able to:
47.01	Demonstrate proficiency and understanding of Security Policy Acceptable Use, Privacy, Separation of Duties, Need to Know, Password Management and SLA's.
47.02	Demonstrate proficiency and understanding of Disposal/Destruction.
47.03	Demonstrate proficiency and understanding of HR policies related to passwords, privileges, and Code of Ethics in hiring and termination situations.
47.04	Demonstrate proficiency and understanding of Incident Response Policy.
48.0	Understand different types of privilege management. – The student will be able to:
48.01	Identify User/Group/Role Management and Single Sign-on.

48.02	Define Centralized vs. Decentralized.
48.03	Understand the importance of Auditing (Privilege, Usage, Escalation).
48.04	Define MAC/DAC/RBAC (Mandatory Access Control/Discretionary Access Control/Role Based Access Control).
49.0	Understand the concepts of cybersecurity guidelines. – The student will be able to:
49.01	Demonstrate an understanding of the concepts of forensics guidelines.
49.02	Explain Systems Architecture and documentation.
49.03	Explain Change Logs and Inventories.
49.04	Explain Classification/Notification, Schema, Retention/Storage, and Destruction.
49.05	Understand and be able to explain the following concepts of risk identification.
49.06	Explain Asset Identification and Risk Assessment.
49.07	Define threat identification and vulnerabilities.
50.0	Understand training of end users, executives and human resources in security vulnerabilities. – The student will be able to:
50.01	Identify effective training strategies and education resources.
50.02	Create appropriate methods of security Information awareness strategies.
50.03	Understand importance of On-line Resources.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Applied Cybersecurity  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y100300
CIP Number	0511100302
Grade Level	30, 31
Standard Length	750 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1122 – Information Security Analysts
Basic Skills Level	Mathematics: 10 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and cybersecurity-related careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of cybersecurity.

The content includes but is not limited to foundational knowledge and skills in computer and network security, security vulnerabilities, attack mechanisms and techniques, intrusion detection and prevention, cryptographic systems, system hardening, risk identification, incidence response, penetration testing, key management, access control, and recovery. Specialized courses focus on database security, planning and analysis, software, and web security.

**Additional Information** relevant to this Career and Technology (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of two occupational completion points (OCPs). To complete this program, students must complete OCP A plus one of the subsequent courses in OCP B.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0018	Cybersecurity Associate		600 hours	15-1122
B	CTS0019	Information Security Manager <b>OR</b>	BUS ED 1 @2 COMPU SCI 6 CYBER TECH 7G INFO TECH 7G	150 hours	15-1122
	CTS0021	Data Security Specialist <b>OR</b>		150 hours	15-1122
	CTS0060	Software Security Specialist <b>OR</b>		150 hours	15-1122
	CTS0085	Web Security Specialist <b>OR</b>		150 hours	15-1122
	CTS0089	Information Security Administrator		150 hours	15-1122

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.



## Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of computer systems.
- 02.0 Demonstrate knowledge of different operating systems.
- 03.0 Develop a familiarity with the information technology industry.
- 04.0 Develop an awareness of microprocessors and digital computers.
- 05.0 Develop an awareness of programming languages.
- 06.0 Develop an awareness of emerging technologies.
- 07.0 Demonstrate an understanding of the Open Systems Interface (OSI) model.
- 08.0 Identify computer components and their functions.
- 09.0 Demonstrate proficiency using the Internet to locate information.
- 10.0 Demonstrate an understanding of Internet safety and ethics.
- 11.0 Demonstrate proficiency using common software applications.
- 12.0 Perform email activities.
- 13.0 Demonstrate proficiency in using presentation software and equipment.
- 14.0 Perform decision-making activities in a multimedia environment.
- 17.0 Demonstrate an understanding of cybersecurity, including its origins, trends, culture, and legal implications.
- 18.0 Describe the national agencies and supporting initiatives involved in cybersecurity.
- 19.0 Discuss the underlying concepts of terms used in cybersecurity.
- 20.0 Demonstrate an understanding of basic computer components, their functions, and their operation.
- 21.0 Demonstrate knowledge of different operating systems.
- 22.0 Demonstrate an understanding of the Open Systems Interface (OSI) model.
- 23.0 Describe the services and protocols that operate in the application, transport, network, and link layers of the OSI Model.
- 24.0 Demonstrate proficiency using computer networks.
- 25.0 Demonstrate an understanding of basic security concepts.
- 26.0 Demonstrate an understanding of legal and ethical issues in cybersecurity.
- 27.0 Demonstrate an understanding of virtualization technology.
- 28.0 Recognize and understand the administration of the following types of remote access technologies.
- 29.0 Understand the application of the following concepts of physical security.
- 30.0 Understand security concerns and concepts of the following types of devices.
- 31.0 Recognize and be able to differentiate and explain the following access control models.
- 32.0 Understand the security concerns for the following types of media.
- 33.0 Explain the following security topologies as they relate to cybersecurity.
- 34.0 Demonstrate an understanding of the technical underpinnings of cybersecurity and its taxonomy, terminology, and challenges.
- 35.0 Demonstrate an understanding of common information and computer system security vulnerabilities.
- 36.0 Demonstrate an understanding of common cyber attack mechanisms, their consequences, and motivation for their use.
- 37.0 Be able to identify and explain the following different kinds of cryptographic algorithms.
- 38.0 Demonstrate an understanding of the following kinds of steganographic techniques and their use in cybersecurity.
- 39.0 Understand how cryptography and digital signatures address the following security concepts.
- 40.0 Understand and be able to explain the following concepts of PKI (Public Key Infrastructure).

- 41.0 Demonstrate an understanding of certificates and their role in cybersecurity.
- 42.0 Demonstrate an understanding of intrusion, the types of intruders, their techniques, and their motivation.
- 43.0 Demonstrate an understanding of Intrusion Detection Systems (IDS).
- 44.0 Describe host-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature).
- 45.0 Describe network-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature).
- 46.0 Demonstrate an understanding of IDS applications.
- 47.0 Demonstrate an understanding of port scanning and network traffic monitoring employed as intrusion detection techniques.
- 48.0 Demonstrate an understanding of firewalls and other means of intrusion prevention.
- 49.0 Demonstrate an understanding of vulnerabilities unique to virtual computing environments.
- 50.0 Demonstrate an understanding of social engineering and its implications to cybersecurity.
- 51.0 Demonstrate an understanding of fundamental security design principles and their role in limiting points of vulnerability.
- 52.0 Demonstrate an understanding of how to configure host systems to guard against cyber intrusion.
- 53.0 Demonstrate an understanding of authentication methods and strategies.
- 54.0 Demonstrate an understanding of methods and strategies for controlling access to computer networks.
- 55.0 Demonstrate an understanding of key network services, their operation, vulnerabilities, and ways in which they may be secured.
- 56.0 Demonstrate an understanding of the processes involved in hardening a computer system or network.
- 57.0 Demonstrate an understanding of Public Key Infrastructure (PKI) management functions, key states, and life cycle/transition considerations.
- 58.0 Demonstrate an understanding of the processes associated with assessing vulnerabilities and risks within an organization.
- 59.0 Demonstrate an understanding of penetration testing, the types of tests and metrics, testing methodologies, and reporting processes.
- 60.0 Demonstrate an understanding of the Incident Response Life Cycle and the activities comprising each phase.
- 61.0 Demonstrate proficiency in cybersecurity risk mitigation planning.
- 62.0 Demonstrate proficiency in establishing a risk management framework.
- 63.0 Demonstrate proficiency in creating a corporate security policy.
- 64.0 Demonstrate proficiency in addressing process risks.
- 65.0 Demonstrate proficiency in addressing physical security risks.
- 66.0 Demonstrate proficiency in cybersecurity contingency planning.
- 67.0 Demonstrate proficiency in cybersecurity disaster recovery planning.
- 68.0 Demonstrate proficiency in cybersecurity business continuity planning.
- 69.0 Demonstrate proficiency in the essential elements of forensic analysis.
- 70.0 Demonstrate an understanding of database design, structure, and operation.
- 71.0 Demonstrate a fundamental understanding of Structured Query Language (SQL).
- 72.0 Demonstrate an understanding of database security policies.
- 73.0 Demonstrate an understanding of database access control, functions, methods, and verification.
- 74.0 Demonstrate an understanding of database vulnerabilities, attack vectors, and associated countermeasures.
- 75.0 Demonstrate an understanding of pre- and post-intrusion actions to facilitate database recovery.
- 76.0 Demonstrate an understanding of software design, structure, and operation.
- 77.0 Demonstrate a fundamental understanding of common software attack vectors.
- 78.0 Demonstrate an understanding input syntax validation.
- 79.0 Demonstrate an understanding of best practices for processing input data to ensure safe and secure program code.
- 80.0 Demonstrate an understanding of the role of environment variables in the operation of software applications.
- 81.0 Demonstrate an understanding of program design strategies for inhibiting elevated privilege attacks.
- 82.0 Demonstrate an understanding of the primary security services used in Internet and intranet environments.

- 83.0 Demonstrate a fundamental understanding of the SSL protocol stack and its elements.
- 84.0 Demonstrate an understanding of IPSec, including its uses, elements, and mechanisms.
- 85.0 Demonstrate an understanding of S/MIME, including its uses, functions, cryptographic algorithms, and key certificates.
- 86.0 Demonstrate an understanding of Kerberos and its role in third-part authentication in a distributed network.
- 87.0 Demonstrate an understanding of identity management and ways in which secure identify information is exchanged across different domains.
- 88.0 Complete a safety skills inventory.
- 89.0 Demonstrate acceptable project values.
- 90.0 Demonstrate the ability to detect and resolve system vulnerabilities.
- 91.0 Plan, organize, and carry out a penetration testing plan.
- 92.0 Demonstrate proficiency in conducting forensic analysis.
- 93.0 Successfully work as a member of a team.
- 94.0 Manage time according to a plan.
- 95.0 Keep acceptable records of progress problems and solutions.
- 96.0 Manage resources.
- 97.0 Use tools, materials, and processes in an appropriate and safe manner.
- 98.0 Research content related to the project and document the results.
- 99.0 Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience.
- 100.0 Demonstrate competency in the area of expertise related to the Applied Cybersecurity education program previously completed that this project is based upon.

Florida Department of Education  
Student Performance Standards

Program Title: Applied Cybersecurity  
Career Certificate Program Number: Y100300

**Course Number: CTS0018**  
**Occupational Completion Point: A**  
**Cybersecurity Associate – 600 Hours – SOC Code 15-1122**

01.0	Demonstrate knowledge, skill, and application of computer systems. – The student will be able to:
01.01	Describe and use current and emerging computer technology and software to perform personal and business related tasks.
01.02	Describe the types of communications and networking systems used in workplace environments.
01.03	Locate and use software application reference materials such as on-line help, vendor bulletin boards, tutorials, and manuals.
01.04	Troubleshoot problems with computer hardware peripherals.
01.05	Describe ethical, privacy, and security issues and problems associated with computers and information systems.
01.06	Demonstrate proficiency in using the basic features of GUI browsers.
02.0	Demonstrate knowledge of different operating systems. – The student will be able to:
02.01	Identify the most common computer operating systems.
02.02	Describe and use industry accepted file naming conventions, particularly in NTFS and FAT file systems.
02.03	Demonstrate proficiency with file management tasks (e.g., folder creation, file creation, backup, copy, delete, open, save).
02.04	Demonstrate a working knowledge of standard file formats.
02.05	Compare and contrast various operating systems (e.g., Android iOS, Windows, Mac, Linux).
02.06	Differentiate between different operating systems and applications.
02.07	Compare and contrast open source and proprietary software.
02.08	Explain how system utilities are used to maintain computer performance.
02.09	Evaluate criteria for selecting an operating system.
03.0	Develop a familiarity with the information technology industry. – The student will be able to:

03.01	Explain how information technology impacts the operation and management of business and society.
03.02	Identify and describe the various ways of segmenting the IT industry (e.g., hardware vs. software, server vs. client, business vs. entertainment, stable vs. mobile).
03.03	Describe how digital technologies (social media) are changing both work and personal lifestyles.
04.0	Develop an awareness of microprocessors and digital computers. – The student will be able to:
04.01	Explain software hierarchy and its impact on microprocessors.
04.02	Explain the need for and use of peripherals.
04.03	Demonstrate proficiency installing and using plug-and-play peripherals.
04.04	Identify the basic concepts of computer maintenance and upgrades.
05.0	Develop an awareness of programming languages. – The student will be able to:
05.01	Explain the need for and use of compilers.
05.02	Identify the three types of programming design approaches (e.g., top-down, structured, object-oriented).
05.03	Compare the various types or classes of programming languages (e.g., compiled, interpretive).
05.04	Differentiate among source code, machine code, interpreters, and compilers.
05.05	Characterize the major categories of programming languages and how they are used.
05.06	Create a model flowchart for a computer program using software applications like RAPTOR or MS VISIO.
05.07	Describe the stages in the software development life cycle and explain how to successfully implement them.
06.0	Develop an awareness of emerging technologies. – The student will be able to:
06.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
06.02	Adhere to published best practices for protecting personal identifiable information when using the Internet.
06.03	Identify trends related to the use of information technology in people's personal and professional lives.
06.04	Characterize how the rapid pace of change in information technology impacts our society.
07.0	Demonstrate an understanding of the Open Systems Interface (OSI) model. – The student will be able to:
07.01	Explain the interrelations of the seven layers of the Open Systems Interface (OSI) as it relates to hardware and software.
07.02	Describe the purpose of the OSI model and each of its layers.
07.03	Explain specific functions belonging to each OSI model layer.

07.04	Understand how two network nodes communicate through the OSI model.
07.05	Discuss the structure and purpose of data packets and frames.
07.06	Describe the two types of addressing covered by the OSI model.
08.0	Identify computer components and their functions. – The student will be able to:
08.01	Identify the internal components of a computer (e.g., power supply, hard drive, mother board, I/O cards/ports, cabling).
08.02	Use common computer and programming terminology.
09.0	Demonstrate proficiency using the Internet to locate information. – The student will be able to:
09.01	Identify and describe web terminology.
09.02	Define Universal Resource Locators (URLs) and associated protocols (e.g., http, ftp, telnet, mailto).
09.03	Compare and contrast the types of Internet domains (e.g., .com, .org, .edu, .gov, .net, .mil).
09.04	Demonstrate proficiency using search engines, including Boolean search strategies.
09.05	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, PDF).
09.06	Compare and contrast the roles of web servers and web browsers.
09.07	Compare MS Web Servers and Linux Web Servers.
10.0	Demonstrate an understanding of Internet safety and ethics. – The student will be able to:
10.01	Describe cyber-bullying and its impact on perpetrators and victims.
10.02	Differentiate between viruses and malware, specifically their sources, ploys, and impact on personal privacy and computer operation, and ways to avoid infection.
10.03	Describe risks associated with sexting, including related legal issues, social engineering aspects, prevention methods, and reporting of offenses.
10.04	Describe the risks associated with online gaming and ways to reduce these risks.
10.05	Describe the intellectual property rights, ethics and legalities of downloading music or videos from the Internet.
10.06	Describe various risks associated with social networking sites and ways to reduce these risks.
10.07	Describe the risks associated with various conferencing programs and ways to reduce these risks.
10.08	Adhere to cyber safety practices with regard to conducting Internet searches, email, chat rooms, and other social network websites.
11.0	Demonstrate proficiency using common software applications. – The student will be able to:

11.01	Compare and contrast the appropriate use of various software applications (e.g., word processing, desktop publishing, graphics design, web browser, email, presentation, database, scheduling, financial management, Java applet, music).
11.02	Demonstrate proficiency in the use of various software applications (e.g., word processing, desktop publishing, graphics design, web browser, email, presentation, database, scheduling, financial management, Java applet, music).
12.0	Perform email activities. – The student will be able to:
12.01	Describe email capabilities and functions.
12.02	Identify components of an email message.
12.03	Identify the components of an email address.
12.04	Identify when to use different email options.
12.05	Attach a file to an email message.
12.06	Forward an email message.
12.07	Use an address book if an address book is available via the school's Outlook server for the student to use.
12.08	Reply to an email message.
12.09	Use the Internet to perform email activities.
12.10	Identify the appropriate use of email and demonstrate related email etiquette.
12.11	Recognize a fraudulent email and deal with it appropriately.
12.12	Identify common problems associated with widespread use of email.
12.13	Create folders to organize email.
13.0	Demonstrate proficiency in using presentation software and equipment. – The student will be able to:
13.01	Produce a presentation that includes music, animation, and digital photography and present it using appropriate technology.
13.02	Using presentation software, create a multimedia presentation that incorporates shot and edited video, animation, music, narration and adheres to good design principles, use of transitions, and effective message conveyance.
13.03	Demonstrate knowledge of the roles and responsibilities of a multimedia production team (e.g. project manager, creative or design director, content experts, writers, graphic designers, animators, sound designers, videographer, interface designers/programmers).
13.04	Collaborate with team members to plan, edit, evaluate, and present a multimedia presentation where individuals on the team function in specific production roles.
13.05	Create a self-running presentation with synchronized audio, convert presentation slides (e.g., PowerPoint) into streaming ASF files for use on the web.
14.0	Perform decision-making activities in a multimedia environment. – The student will be able to:

14.01	Determine work priorities, the audience, project budgets, project specifications and the production schedule.
14.02	Evaluate and select appropriate software packages and multimedia tools to complete assigned tasks.
14.03	Present and defend design projects.
17.0	Demonstrate an understanding of cybersecurity, including its origins, trends, culture, and legal implications. – The student will be able to:
17.01	Define cybersecurity.
17.02	Describe how information security evolved into cybersecurity and the impact of the Internet on the pace and nature of the evolution.
17.03	Describe the individual elements that comprise the CIA triad (i.e., Confidentiality, Integrity, Availability).
17.04	Define and explain the various types of hackers and the role each plays in cybersecurity.
17.05	Describe various methodologies used by hackers and the basis for their employment.
18.0	Describe the national agencies and supporting initiatives involved in cybersecurity. – The student will be able to:
18.01	Describe the role of the National Security Agency.
18.02	Describe current trends in cyber attacks and strategies for combating them.
18.03	Describe the legal implications of computer hacking and other forms of cyber attacks.
18.04	Understand the importance of the weekly bulletins distributed by the United States Computer Emergency Readiness Team (US-CERT).
18.05	Determine if any software or hardware on a given network has vulnerabilities outlined in the most recent US-CERT bulletin.
19.0	Discuss the underlying concepts of terms used in cybersecurity. – The student will be able to:
19.01	Differentiate between cybersecurity and information assurance.
19.02	Define confidentiality and give examples of security breaches.
19.03	Define integrity and give examples of security breaches.
19.04	Define authenticity and give examples of security breaches.
19.05	Define accountability (non-repudiation) and give examples of security breaches.
20.0	Demonstrate an understanding of basic computer components, their functions, and their operation. – The student will be able to:
20.01	Describe the internal components of a computer (e.g., power supply, hard drive, mother board, I/O cards/ports, cabling).



20.02	Demonstrate and understanding of common computer and programming terminology.
20.03	Explain the physical and logical architecture of a microcomputer system.
20.04	Describe the file types used in the operation of a computer.
20.05	Compare and contrast memory technologies (e.g., RAM, ROM, virtual memory, memory management).
21.0	Demonstrate knowledge of different operating systems. – The student will be able to:
21.01	Compare operating system file naming conventions.
21.02	Describe the common elements that comprise the architecture of an operating system (e.g., kernel, file manager, memory manager, device manager, network manager).
21.03	Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).
21.04	Demonstrate a working knowledge of standard file formats.
21.05	Describe the purpose of various operating systems (e.g., Windows, Mac, iOS, Android and Linux).
21.06	Describe the difference between client and network operating systems.
21.07	Differentiate between different operating systems and applications and Macros.
21.08	Explain the basics of boot sequences, methods and startup utilities.
21.09	Compare and contrast open source and proprietary software.
21.10	Describe common system utilities used in performing computer maintenance.
22.0	Demonstrate an understanding of the Open Systems Interface (OSI) model. – The student will be able to:
22.01	Explain the interrelations of the seven layers of the Open Systems Interface (OSI) as it relates to hardware and software.
22.02	Describe the purpose of the OSI model and each of its layers.
22.03	Explain specific functions belonging to each OSI model layer.
22.04	Understand how two network nodes communicate through the OSI model.
22.05	Discuss the structure and purpose of data packets and frames.
22.06	Describe the two types of addressing covered by the OSI model.
23.0	Describe the services and protocols that operate in the application, transport, network, and link layers of the OSI Model. – The student will be able to:
23.01	Describe the services and protocols used in the OSI Application Layer (i.e., DHCP, DNS, FTP, HTTP, SMTP, Telnet, IMAP).

23.02	Describe the services and protocols used in the OSI Transport Layer (i.e., TCP, TSL/SSL, UDP).
23.03	Describe the services and protocols used in the OSI Network Layer (i.e., IP, ICMP, IGMP, IPSec).
23.04	Describe the services and protocols used in the OSI Link Layer (i.e., ARP, OSPF, L2TP, PPP).
24.0	Demonstrate proficiency using computer networks. – The student will be able to:
24.01	Define networking and describe the purpose of a network.
24.02	Describe the conceptual background of digital networks including terminology and basics.
24.03	Describe various types of networks and the advantages and disadvantages of each (e.g. peer to peer, client/server, ROI).
24.04	Describe the use, advantages, and disadvantages of various network media (e.g. thinnet cable, coaxial, twisted pair (cat 5), fiber optics).
24.05	Describe the function of various network devices (e.g. hub, switched hub or switch, router bridge, gateway, access points).
24.06	Describe how network devices are identified (i.e., IP addressing).
24.07	Explain the protocols commonly used in a network environment.
24.08	Differentiate between public and private IP addresses.
24.09	Describe the common ports and corresponding protocols used in a network.
24.10	Describe the difference between the Internet and intranet.
24.11	Compare and contrast IP Version 6 and IP Version 4.
24.12	Compare and contrast the different methods for network connectivity (e.g. broadband, wireless, Bluetooth, cellular).
24.13	Discuss the differences between Local Area Network (LAN), Wide Area Network (WAN), Metropolitan Area Network (MAN), and Virtual Private Network (VPN).
25.0	Demonstrate an understanding of basic security concepts. – The student will be able to:
25.01	Distinguish between vulnerability and a threat.
25.02	Discuss the different types of attacks (e.g., active, passive).
25.03	Define security policy and explain its role in cybersecurity.
25.04	Describe the basic methods of authentication (e.g., password, biometrics, smart cards, 2-factor authentication, multifactor authentication).

25.05	Describe the various forms of encryption methodologies (e.g., symmetric, asymmetric, block cipher, stream cipher).
25.06	Describe hash functions and their role in authentication.
25.07	Describe various method of access control used in computer security (e.g., policies, Groups, Access Control List (ACL)).
26.0	Demonstrate an understanding of legal and ethical issues in cybersecurity. – The student will be able to:
26.01	Define cyber crime and discuss the challenges facing law enforcement.
26.02	Identify the key legislative acts that impact cybersecurity.
26.03	Describe the Federal criminal code related to computers and give examples of cyber crimes and penalties, particularly those involving inappropriate access.
26.04	Discuss digital forensics and its role in cybersecurity.
26.05	Distinguish among the Intellectual Property Rights of trademark, patent, and copyright.
26.06	Explain digital rights management and the implications of the Digital Millennium Copyright Act.
26.07	Describe the implications of various social media on the safeguarding of personal or sensitive information.
26.08	Describe various safeguards that can be employed to help ensure that sensitive or confidential information is not inadvertently divulged or obtained.
27.0	Demonstrate an understanding of virtualization technology. – The student will be able to:
27.01	Define virtual computing.
27.02	Explain the benefits of virtual computing.
27.03	Differentiate between guest and host operating systems.
27.04	Install desktop virtualization software.
27.05	Describe the role of the hypervisor.
27.06	Create and upgrade a virtual machine.
27.07	Optimize the performance of a virtual machine.
27.08	Preserve the state of a virtual machine.
27.09	Clone, move and share virtual machines.
27.10	Use basic(static) and dynamic virtual disks and disk drives.

27.11	Configure a virtual network.
27.12	Connect devices to a virtual machine.
27.13	Enable security settings on a virtual machine.
28.0	Recognize and understand the administration of the following types of remote access technologies. – The student will be able to:
28.01	Configure 802.1x authentication for a given scenario.
28.02	Connect clients to a VPN.
28.03	Understand Authentication, Authorization and Accounting (AAA) management.
28.04	Differentiate between TACACS+ (Terminal Access Controller Access Control System) and RADIUS.
28.05	Differentiate between L2TP and PPTP (Layer Two Tunneling Protocol/Point to Point Tunneling Protocol) protocols as they apply to VPN options.
28.06	Implement the use of SSH (Secure Shell).
28.07	Implement the use of IPSEC (Internet Protocol Security).
28.08	Identify vulnerabilities associated with authentication.
28.09	Understand ways to implement VOIP technologies.
29.0	Understand the application of the following concepts of physical security. – The student will be able to:
29.01	Configure access controls including biometric devices, keypads and security tokens.
29.02	Recognize social engineering attempts.
29.03	Evaluate environmental controls (e.g., EMI shielding, temperature, humidity and fire suppression).
29.04	Develop a method of training users to recognize, report and avoid social engineering attempts.
29.05	Identify components of physical security including: mantraps, motion detection, alarm systems, locks, video surveillance and fences/barricades.
29.06	Install a camera for a video surveillance system.
29.07	Configure an alarm system including a keypad and motion detector.
29.08	Recognize vulnerabilities associated with physical security.
29.09	Explain how a mantrap is used as a counter measure against tailgating.
30.0	Understand security concerns and concepts of the following types of devices. – The student will be able to:

30.01	Configure software and hardware firewalls.
30.02	Configure and secure routers.
30.03	Apply security settings to switches.
30.04	Configure and secure wireless devices.
30.05	Secure a LAN connected to a DSL/cable modem.
30.06	Configure a RAS (Remote Access Server) for remote connectivity.
30.07	Securely deploy a PBX (Private Branch Exchange).
30.08	Explain the benefits of implementing a VPN (Virtual Private Network).
30.09	Deploy IDS (intrusion detection system) and IPS (intrusion prevention systems).
30.10	Analyze the performance, efficiency and security of the network based on network monitoring and diagnostic software.
30.11	Employ techniques used to lock down workstations.
30.12	Configure and secure servers for a given scenario.
30.13	Understand and assess the security of mobile devices including but not limited to those using the Android, iOS and Windows platforms.
31.0	Recognize and be able to differentiate and explain the following access control models. – The student will be able to:
31.01	Understand access control as it applies to MAC (Mandatory Access Control).
31.02	Understand access control as it applies to DAC (Discretionary Access Control).
31.03	Understand access control as it applies to RBAC (Role Based Access Control).
32.0	Understand the security concerns for the following types of media. – The student will be able to:
32.01	Understand and identify security concerns with the use of Coaxial Cable.
32.02	The student should be able to identify and understand security concerns for UTP/STP (Unshielded Twisted Pair / Shielded Twisted Pair).
32.03	Identify and understand security concerns fiber optic cable.
32.04	Identify security concerns associated with removable media.
32.05	Address pitfalls associated with tape backups.
32.06	Address pitfalls associated with CD-R (Recordable Compact Disks).

32.07	Apply drive encryption to hard drives.
32.08	Diskettes.
32.09	Secure flash drives.
32.10	Smartcards. Secure USB memory.
33.0	Explain the following security topologies as they relate to cybersecurity. – The student will be able to:
33.01	Determine Security Zones.
33.02	Point out vulnerabilities on a DMZ (Demilitarized Zone).
33.03	Explain the security benefits of using an intranet.
33.04	Explain the security benefits of using an extranet.
33.05	Secure a VLAN (Virtual Local Area Network).
33.06	Describe the security benefits associated with NAT (Network Address Translation).
33.07	Justify the implementation of tunneling, for security purpose.
34.0	Demonstrate an understanding of the technical underpinnings of cybersecurity and its taxonomy, terminology, and challenges. – The student will be able to:
34.01	Explain the various elements that make up the security taxonomy used by the U.S. Computer Emergency Readiness Team (CERT).
34.02	Describe the challenges associated with achieving and maintaining computer security.
34.03	Discuss the range of potential consequences of various forms of security breaches.
34.04	Describe various defense mechanisms, techniques, and methodologies (e.g., antivirus, anti-malware, protocol analyzers and scans, analyzing email headers, patch management).
34.05	Compare and contrast mechanisms employed in passive and active cyber attacks.
34.06	Describe the difference between an inside and an outside attack.
34.07	Describe vulnerabilities associated with each element of the CIA Triad.
34.08	Explain the differences between hardware, software, data, and network assets susceptible to cyber attack.
34.09	Describe the tools and technologies used in cybersecurity.
34.10	Define intrusion detection and discuss its role in cybersecurity (e.g., HIDS and NIDS).
34.11	Explain what is meant by the term countermeasures (e.g., NIPS and HIPS).

34.12	Describe the role recovery plays in cybersecurity (e.g., Business Continuity Plan).
35.0	Demonstrate an understanding of common information and computer system security vulnerabilities. – The student will be able to:
35.01	Describe the basic categories of vulnerabilities associated with cybersecurity (i.e., hardware, software, network, human, physical, organizational).
35.02	Describe the ways in which various social networks are cybersecurity targets.
35.03	Describe footprinting and explain how it is used to reveal system vulnerabilities.
35.04	Explain why default values and technical controls are points of vulnerability and describe the hardening efforts being taken by government and industry.
35.05	Describe the process of port scanning and explain why it is so prevalent in cybersecurity.
35.06	Describe what is meant by password strength and explain its relationship to vulnerability.
35.07	Distinguish between a weak and a strong password.
35.08	Describe some of the ways in which intruders are able to cover their tracks.
35.09	Describe the circumstances under which a computer system is vulnerable to a denial of service attack.
36.0	Demonstrate an understanding of common cyber attack mechanisms, their consequences, and motivation for their use. – The student will be able to:
36.01	Describe spoofing as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.02	Describe the introduction of malware or spyware as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.03	Describe the use of grayware as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.04	Describe the use of computer viruses or worms as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.05	Describe Logic Bombs as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.06	Describe botnet and rootkit as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.07	Describe the introduction of a Trojan Horse as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.08	Describe DNS poisoning as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.09	Describe buffer overflow as an attack mechanism and discuss its consequences and common motivating factors for its use.
36.10	Understand the risk associated with a zero-day exploit.
36.11	Understand risks associated with P2P networking including the Gnutella protocol and Torrents.

37.0	Be able to identify and explain the following different kinds of cryptographic algorithms. – The student will be able to:
37.01	Hashing Functions.
37.02	Symmetric Keys.
37.03	Asymmetric Keys.
37.04	Kerberos.
38.0	Demonstrate an understanding of the following kinds of steganographic techniques and their use in cybersecurity. – The student will be able to:
38.01	Network steganographic methods (e.g., WLAN).
38.02	Digital steganographic methods (e.g., image encryption, audio, mimic functions, video, packet manipulation).
39.0	Understand how cryptography and digital signatures address the following security concepts. – The student will be able to:
39.01	Confidentiality.
39.02	Integrity.
39.03	Authentication.
39.04	Non-Repudiation.
39.05	Access Control.
40.0	Understand and be able to explain the following concepts of PKI (Public Key Infrastructure). – The student will be able to:
40.01	Certificates (e.g., policies, practice statements).
40.02	Revocation.
40.03	Trust Models.
41.0	Demonstrate an understanding of certificates and their role in cybersecurity. – The student will be able to:
41.01	Describe the role of a Certificate Authority (CA).
41.02	Describe Registration Authority (RA) and its relevance to security certificates.
41.03	Compare and contrast SSL/TLS X.509-compliant certificates with PGP-compliant certificates.
41.04	Describe the events that make up the lifecycle of a certificate.
41.05	Describe how root certificate distribution works.



42.0	Demonstrate an understanding of intrusion, the types of intruders, their techniques, and their motivation. – The student will be able to:
42.01	Define intrusion.
42.02	Describe the classes of intruders (i.e., masquerader, misfeator, clandestine user).
42.03	Describe what is meant by a hacker and discuss their role in cybersecurity.
42.04	Compare and contrast the “black hat”, “white hat”, “blue hat”, and “grey hat” hacker cultures (i.e., computer criminal versus computer security expert).
42.05	Describe various techniques used by hackers to achieve intrusion.
43.0	Demonstrate an understanding of Intrusion Detection Systems (IDS). – The student will be able to:
43.01	Describe the three logical components that comprise an IDS (i.e., sensors, analyzers, user interface).
43.02	Explain how user behavior relates to the detection of an intruder.
43.03	Describe the essential requirements for any IDS.
44.0	Describe host-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature). – The student will be able to:
44.01	Describe anomaly detection, specifically threshold and profile-based approaches.
44.02	Describe the types of audit records employed in intrusion detection (i.e., native, detection-specific).
44.03	Describe signature detection, specifically rule-based anomaly and penetration identification approaches.
45.0	Describe network-based IDS, its capabilities, and its approaches to detection (i.e., anomaly, signature). – The student will be able to:
45.01	Describe the primary approach for intrusion detection in a network.
45.02	Compare and contrast inline and passive sensors.
45.03	Discuss typical placement of sensors in a network-based IDS environment and explain the rationale for each.
46.0	Demonstrate an understanding of IDS applications. – The student will be able to:
46.01	Describe the operation, typical activities, and outputs of an intrusion detection system.
46.02	Describe some of the limitations of intrusion detection systems.
46.03	Differentiate between an intrusion detection system (passive) and an intrusion prevention (reactive) system.
46.04	Compare and contrast several of the intrusion detection systems available on the current market.
47.0	Demonstrate an understanding of port scanning and network traffic monitoring employed as intrusion detection techniques. – The student will be able to:

47.01	Describe the process of monitoring/detecting port scanning attacks and associated patterns.
47.02	Explain how the monitoring and analysis of network traffic can be used to detect intrusion.
47.03	Utilize network monitoring and analysis tools to detect intrusion and anomalies.
48.0	Demonstrate an understanding of firewalls and other means of intrusion prevention. – The student will be able to:
48.01	Describe the purpose and limitations of firewalls.
48.02	Describe the four types of firewalls (i.e., packet filtering, stateful inspection, application-level gateway, circuit-level gateway).
48.03	Describe the use of honeypots as an intrusion prevention technique.
48.04	Explain how security policies are used to prevent intruders.
48.05	Explain how Access Control Lists (ACLs) are used to prevent intrusion.
49.0	Demonstrate an understanding of vulnerabilities unique to virtual computing environments. – The student will be able to:
49.01	Describe the limitations of traffic monitoring within virtual networks.
49.02	Discuss the primary vulnerability of virtual operating systems.
49.03	Describe the “hypervisor” and explain its role in securing a virtual environment.
50.0	Demonstrate an understanding of social engineering and its implications to cybersecurity. – The student will be able to:
50.01	Define social engineering and describe its role in cybersecurity.
50.02	Discuss common mechanisms that constitute social engineering (e.g., phishing, baiting, quid pro quo, pretexting).
50.03	Describe the variety of attacks targeting the human element.
50.04	Describe countermeasures that can be used to counter social engineering attacks.
51.0	Demonstrate an understanding of fundamental security design principles and their role in limiting points of vulnerability. – The student will be able to:
51.01	Discuss the three over-arching security design principles (i.e., only necessary, simple, ease of use).
51.02	Describe the principle of least privilege as it relates to computer security.
51.03	Describe the principle of separation of duties as it relates to computer security.
51.04	Describe the principle of defense in depth as it relates to computer security.
51.05	Describe the principle of fail secure or fail safe and false positive or false negative as it relates to computer security.

51.06	Describe the principle of economy of mechanism as it relates to computer security.
51.07	Describe the principle of complete mediation as it relates to computer security.
51.08	Describe the principle of open design as it relates to computer security.
51.09	Describe the principle of least common mechanism as it relates to computer security.
51.10	Describe the principle of psychological acceptability as it relates to computer security.
51.11	Describe the principle of leveraging existing components as it relates to computer security.
51.12	Describe the principle of weakest link as it relates to computer security.
51.13	Describe the principle of single point of failure as it relates to computer security.
52.0	Demonstrate an understanding of how to configure host systems to guard against cyber intrusion. – The student will be able to:
52.01	Describe the security features and options available for configuring network routers to prevent intrusion.
52.02	Describe the various types of firewalls (i.e., packet filtering, stateful, application-level gateway, circuit-level gateway) and how each can be used to prevent intrusion.
52.03	Explain the configuration and operation of a Demilitarized Zone (DMZ) host, including the key services contained within the zone.
52.04	Describe the role of security zones, content filters, subnets, and trusted zones in configuring a network infrastructure.
53.0	Demonstrate an understanding of authentication methods and strategies. – The student will be able to:
53.01	Describe the strengths, vulnerabilities, and countermeasures related to the use of passwords for authentication.
53.02	Describe ways in which passwords are compromised and techniques/models for strengthening.
53.03	Explain token authentication methods (e.g., memory cards, smart cards) and limitations.
54.0	Demonstrate an understanding of methods and strategies for controlling access to computer networks. – The student will be able to:
54.01	Compare and contrast the three primary categories of access control (i.e., discretionary, mandatory, role-based).
54.02	Describe the underlying principles of authorization as an access control mechanism applicable to individuals, system services, subjects, objects.
54.03	Discuss the key features of an access control system (i.e., reliable input, granularity, least privilege, separation of duty, open/close policies, conflict resolution, administration).
54.04	Describe the three elements of access control (i.e., subject, object, rights).
54.05	Describe access rights (i.e., read, write, execute, delete, create, search) and their use in establishing individual and group access control policies.
54.06	Compare and contrast the use, operation, and limitations of Access Control Matrix (ACM), Access Control Lists (ACLs), and Capability Tickets in a network environment.

54.07	Describe the UNIX file access control schema.
54.08	Explain the relationship between security policies and access control.
54.09	Describe the use and conceptual operation of formal security policy models (e.g., Bell-La Padula (BLP), Chinese Wall Model (CWM), Harrison Ruzzo Ullman (HRU)).
54.10	Describe the use, strengths, and vulnerabilities of group policies in access control and strategies for ensuring safety.
54.11	Describe the key entities, relationships, and functions that comprise Role-Based Access Control (RBAC), including privilege management considerations.
55.0	Demonstrate an understanding of key network services, their operation, vulnerabilities, and ways in which they may be secured. – The student will be able to:
55.01	Describe the operation of Dynamic Host Configuration Protocol (DHCP), its vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
55.02	Describe the operation of the Domain Name System (DNS) service, its role in a network environment, its vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
55.03	Describe the operation of the Simple Mail Transport Protocol (SMTP), its role in a network environment, its vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
55.04	Describe the operation of the File Transfer Protocol (FTP) and Telnet, their role in a network environment, their vulnerabilities, typical cyber attacks, and potential countermeasure strategies.
56.0	Demonstrate an understanding of the processes involved in hardening a computer system or network. – The student will be able to:
56.01	Describe hardening and some of the general approaches for securing a computer network.
56.02	Describe and apply the process by which a web server is hardened against their typical cyber attacks.
56.03	Describe and apply the process by which a mail server is hardened against their typical cyber attacks.
56.04	Describe and apply the process by which a FTP server is hardened against their typical cyber attacks.
56.05	Describe and apply the process by which a file/print server is hardened against their typical cyber attacks.
56.06	Describe and apply the process by which data repositories are hardened against their typical cyber attacks.
56.07	Describe and apply the process by which Directory Services is hardened against their typical cyber attacks.
56.08	Describe and apply the process by which various network appliances are hardened against their typical cyber attacks.
57.0	Demonstrate an understanding of Public Key Infrastructure (PKI) management functions, key states, and life cycle/transition considerations. – The student will be able to:
57.01	Compare and contrast the forms, limitations, and vulnerabilities associated with centralized and decentralized key management schemas, including the PKI web of trust model.
57.02	Describe key escrow, its role in key management, its advantages, and its risks.
57.03	Differentiate between key backup and key escrow.

57.04	Explain the role of a key's expiration date, its implications on the key's validity, and its relationship to deactivation.
57.05	Describe the circumstances under which a key might be revoked, who has authority to revoke a key, and how revocation is communicated.
57.06	Compare and contrast key suspension and key revocation.
57.07	Describe ways in which key recovery might be achieved, who is authorized to recover keys, and associated vulnerabilities to attack.
57.08	Compare and contrast key renewal and key replacement, who is authorized to initiate renewal or replacement, and associated vulnerabilities to attack.
57.09	Describe the circumstances under which a key might be destroyed, the considerations prior to destruction, and associated vulnerabilities to compromise or attack.
58.0	Demonstrate an understanding of the processes associated with assessing vulnerabilities and risks within an organization. – The student will be able to:
58.01	Describe the process of asset identification relative to risk assessment and the considerations or criteria used in identifying assets requiring protection.
58.02	Describe the process of threat identification, including identifying the types of threats, asset vulnerabilities, and threat sources.
58.03	Describe the process of risk assessment, including determination of attack probability, attack consequences, and assignment of risk priorities.
58.04	Evaluate an existing security posture and identify gaps and vulnerabilities in security.
59.0	Demonstrate an understanding of penetration testing, the types of tests and metrics, testing methodologies, and reporting processes. – The student will be able to:
59.01	Describe the types of penetration tests (i.e., human, physical, wireless, data networks, telecommunications), the goals of each type, the metrics tested, and the value of their results.
59.02	Compare and contrast the processes of black box versus white box penetration testing, including their characteristics, limitations, and appropriateness.
59.03	Define attack vector and explain its relationship and importance to penetration testing.
59.04	Describe common testing methodologies and standards used in penetration testing.
59.05	Describe the salient points, structure, detail, and documentation typically addressed in reporting and debriefing the results of penetration testing.
59.06	Detect malicious and abnormal activities through logs, intrusion detection systems, and other utilities and appliances.
59.07	Reproduce methods that intruders use to gain unauthorized access to a network system for purposes of compromising information assets.
59.08	Deploy proprietary and/or open source tools to test known technical vulnerabilities in networked systems.
59.09	Determine which vulnerabilities are exploitable and estimate the risk and impact of potential exploitations.
59.10	Recommend appropriate mitigation procedures against discovered vulnerabilities and security gaps.

59.11	Model the ethics of a licensed Penetration Tester or Computer Security Specialist.
60.0	Demonstrate an understanding of the Incident Response Life Cycle and the activities comprising each phase. – The student will be able to:
60.01	Describe the activities that make up the Preparation Phase of the Incident Response Life Cycle, including identification of useful tools and resources.
60.02	Describe the activities that make up the Detection and Analysis Phase of the Incident Response Life Cycle, including identification of indication sources, analysis of resulting signs of an intrusion event, documentation and notification of the incident.
60.03	Describe the factors to consider when prioritizing an incident.
60.04	Describe the activities that make up the Containment, Eradication, and Recovery Phase of the Incident Response Life Cycle, including selecting a containment strategy, collecting and preserving evidence for forensic analysis, identifying the attacker, re-securing the system and system restoration.
60.05	Describe the activities that make up the Post Incident Activity Phase of the Incident Response Life Cycle, including identification of lessons learned and evidence retention.

**Course Number: CTS0019**  
**Occupational Completion Point: B**  
**Information Security Manager – 150 Hours – SOC Code 15-1122**

61.0	Demonstrate proficiency in cybersecurity risk mitigation planning. – The student will be able to:
61.01	Describe the major activities and security controls that are implemented as part of a sound risk management program.
61.02	Discuss the rationale for executive sponsorship and delineated management responsibilities in successfully implementing a risk management program.
62.0	Demonstrate proficiency in establishing a risk management framework. – The student will be able to:
62.01	Describe the importance of creating a system definition for use in assessing vulnerabilities and risks.
62.02	Describe the major elements of a system definition.
62.03	Differentiate among critical assets, cyber assets, and critical cyber assets.
62.04	Explain why cyber assets are classified as public, restricted, confidential, or private and why this plays a role in creating a risk management framework.
62.05	Compare and contrast the classes of cyber assets (i.e., public, restricted, confidential, private) and give examples of each.
62.06	Create a system definition that identifies all cyber assets, their class, and their risk category (e.g., critical).
62.07	Describe an Electronic Security Perimeter (ESP) and discuss its role in formulating a risk management framework.
62.08	Describe the process and goals of a vulnerability assessment of ESP access points.
62.09	Define risk level and explain the variabilities of its components.
62.10	Describe ways in which system vulnerability may be ranked according to impact (e.g., safety, outage, privacy, monetary).
62.11	Describe some of the security controls (e.g., access control, training, audit, configuration, maintenance) that come into play when determining the appropriate risk mitigation strategy.
62.12	Compare and contrast a top-down and a bottoms-up analysis approach for identifying and mitigating risks.
62.13	Describe the range of testing/evaluation and associated tools used to monitor mitigation control effectiveness.
62.14	Create a risk management framework.
63.0	Demonstrate proficiency in creating a corporate security policy. – The student will be able to:
63.01	Describe the best practices and security controls that typify a sound corporate security policy.
63.02	Discuss the elements of a corporate security policy, including policy management, personnel and training, critical asset management, ESP, physical security, incident reporting and response, disaster recovery and business continuity plans.
63.03	Describe the need for specific implementation and enforcement processes as part of a corporate security policy.

63.04	Explain the controls required for addressing personnel risks in a corporate security policy (e.g., training, hiring due diligence, enforcement of “least privilege,” access revocation).
64.0	Demonstrate proficiency in addressing process risks. – The student will be able to:
64.01	Describe the best practices and security controls typically implemented for assessing and mitigating operational risks, including:
64.01.1	Periodic risk assessment.
64.01.2	Enforce access control, monitoring, and logging.
64.01.3	Perform disposal/redeployment of assets.
64.01.4	Enforce change control and configuration management.
64.01.5	Conduct vulnerability assessments.
64.01.6	Control, Monitor, and log all access to assets.
64.01.7	Configuration and maintenance.
64.01.8	Ensure incident handling processes.
64.01.9	Provide for contingency planning.
64.02	Create an organized mitigation table that identifies operational or process risks, the potential impact of the risk, and specific actions required to mitigate the risk.
65.0	Demonstrate proficiency in addressing physical security risks. – The student will be able to:
65.01	Describe the best practices and security controls that ensure good physical security of critical infrastructure and assets.
65.02	Discuss the resulting potential for compromise once physical security is breached.
65.03	Create an organized mitigation table that identifies physical security risks, the potential impact of the risk, and specific actions required to mitigate the risk.
66.0	Demonstrate proficiency in cybersecurity contingency planning. – The student will be able to:
66.01	Define resiliency and its relationship to contingency planning.
66.02	Describe the purpose and scope of an Information Systems Contingency Plan (ISCP).
66.03	Identify the five main components of a contingency plan (i.e., Supporting Information, Activation and Notification, Recovery, Reconstitution, and Appendices).
66.04	Describe the contingency planning process and the rationale for each step in the process.
66.05	Explain the three step process for conducting a business impact analysis (i.e., determine recovery criticality, identify resource requirements, identify recovery priorities).



66.06	Compare and contrast Maximum Tolerable Downtime (MTD), Recovery Time Objective (RTO), and Recovery Point Objective (RPO).
66.07	Discuss the criteria typically used to activate the contingency plan.
66.08	Discuss the role of backup and recovery considerations in contingency planning.
66.09	Create a contingency plan that includes roles and responsibilities, a business impact analysis with contingency strategies/solutions, outage assessment, resource recovery priorities, backup and recovery strategies, and testing/training considerations.
67.0	Demonstrate proficiency in cybersecurity disaster recovery planning. – The student will be able to:
67.01	Describe the purpose and scope of a cybersecurity disaster recovery plan.
67.02	Describe various recovery strategies according to their appropriateness.
67.03	Explain the key considerations when formalizing a disaster recovery plan.
67.04	Discuss the role of data collection relative to disaster recovery.
67.05	Identify the types, purposes, and role of documentation during disaster recovery.
67.06	Discuss the role of testing in a disaster recovery plan.
68.0	Demonstrate proficiency in cybersecurity business continuity planning. – The student will be able to:
68.01	Describe the purpose and scope of a cybersecurity business continuity plan.
68.02	Explain the concept of fault tolerance and discuss its role in business continuity planning.
68.03	Identify and use various utilities employed for the purpose of business continuity.
68.04	Describe the role of backups for ensuring business continuity.
69.0	Demonstrate proficiency in the essential elements of forensic analysis. – The student will be able to:
69.01	Describe the four phases of forensic analysis and discuss the activities performed in each phase.
69.02	Describe the forensic and evidentiary considerations when determining containment.
69.03	Describe the types and sources of data collected for forensic analysis.
69.04	Explain the various forms of data and associated collection/retrieval tools for the application transport, IP, and link layers.
69.05	Explain the processes by which data is collected for analysis.
69.06	Describe the role of system event logs in data collection.
69.07	Describe the role of the process log in data collection.

69.08 Describe the processes associated with preserving evidence collected for forensic purposes.

69.09 Describe how the chain of custody can be maintained for evidence collected during a forensic analysis effort.

**Course Number: CTS0021**  
**Occupational Completion Point: B**  
**Data Security Specialist – 150 Hours – SOC Code 15-1122**

70.0 Demonstrate an understanding of database design, structure, and operation. – The student will be able to:

70.01 Describe a relational database and its key elements.

70.02 Describe the Entity Relationship Model (ERM) and relate how it is a factor in database security.

70.03 Describe the process of normalization and explain its role in database security.

70.04 Differentiate between one-to-many, many-to-many and one-to-one relationships.

70.05 Define referential integrity and describe its implications on database security.

70.06 Discuss the role of authentication in database security.

71.0 Demonstrate a fundamental understanding of Structured Query Language (SQL). – The student will be able to:

71.01 List the capabilities of SQL SELECT statements.

71.02 Execute basic SQL statements, including SELECT, INSERT, and UPDATE.

71.03 Apply the concatenation operator to link columns to other columns, arithmetic expressions, or constant values to create a character expression.

71.04 Use column aliases to rename columns in the query result.

71.05 Use SQL to display the structure of a table.

71.06 Apply SQL syntax to restrict the rows returned from a query.

71.07 Demonstrate application of the WHERE clause syntax.

71.08 Apply the proper comparison operator to return a desired result.

71.09 Create, drop, rename and truncate tables using SQL.

71.10 Create and remove an index using a SQL statement.

71.11 Create or modify users and roles using SQL statements.

71.12 Use the GRANT and REVOKE SQL statements to control access.

71.13 Differentiate between Data Definition Language (DDL) and Data Manipulation Language (DML) SQL statements and discuss their respective implications to database security.

72.0 Demonstrate an understanding of database security policies. – The student will be able to:

72.01	Explain the role of the Database Management System (DBMS) in maintaining database security.
72.02	Describe three aspects of system level security related to databases (i.e., user privilege schema, user authentication, operating system level privileges).
72.03	Describe the mechanisms that control access to and use of the database at the object level.
72.04	Explain how role-based privilege assignment can be used as a data security model.
72.05	Compare and contrast the implications of connecting to a database with administrator versus user privileges.
73.0	Demonstrate an understanding of database access control, functions, methods, and verification. – The student will be able to:
73.01	Compare and contrast rights and privileges as they relate to database security.
73.02	Describe the manner in which database user rights and privileges are controlled (e.g., granted, revoked).
73.03	Describe application access rights and discuss their role in a database security schema.
73.04	Compare and contrast table, column, and row level security, including VIEW implications.
73.05	Describe fine-grained access control and its use in database security.
73.06	Describe the operation of a database firewall and explain its role in a database security schema.
73.07	Describe how database security policies may be used to trigger security auditing events.
73.08	Describe the various types of auditing (e.g., statement, privilege, object, fine-grained) and associated records.
74.0	Demonstrate an understanding of database vulnerabilities, attack vectors, and associated countermeasures. – The student will be able to:
74.01	Describe the SQL Injection attack vector and explain its potential consequences (e.g., privilege escalation, data compromise, data destruction).
74.02	Describe database inference as a vulnerability and explain how sensitive information can be compromised inadvertently.
74.03	Discuss ways in which to prevent or limit database inference at design time and query time.
74.04	Compare and contrast the various countermeasures and strategies to prevent an SQL injection from being successful.
74.05	Compare and contrast the ways in which encryption might be applied to a database (i.e., database, fields, records, columns) and discuss the tradeoffs of each.
75.0	Demonstrate an understanding of pre- and post-intrusion actions to facilitate database recovery. – The student will be able to:
75.01	Describe the criteria which might be employed to trigger an intrusion or breach alarm.
75.02	Identify the sources for confirming and tracking intrusion.
75.03	Describe the tools and methodologies used to determine the scope of data compromise.

75.04 Assess an intrusion, determine the scope of compromise, and restore compromised data.

75.05 Describe the appropriate actions related to database recovery during incidence response.

**Course Number: CTS0060**  
**Occupational Completion Point: B**  
**Software Security Specialist – 150 Hours – SOC Code 15-1122**

76.0	Demonstrate an understanding of software design, structure, and operation. – The student will be able to:
76.01	Describe a typical software application and its key elements.
76.02	Compare and contrast software quality and software security in terms of development time, testing, and implementation.
76.03	Explain how security can be a software design parameter and discuss the inherent trade-offs during the development life cycle.
76.04	Describe the common failings in software security (e.g., input handling, inadequate testing, incomplete/incorrect algorithms, memory misuse, holes for privilege escalation).
77.0	Demonstrate a fundamental understanding of common software attack vectors. – The student will be able to:
77.01	Describe how buffer overflow attacks can be prevented through input validation and proper interpretation.
77.02	Describe a command injection attack, how it can occur, and the potential consequences.
77.03	Describe an SQL injection attack, how it can occur, and the potential consequences.
77.04	Describe a code injection attack, including PHP remote code injection, how it can occur, and the potential consequences.
77.05	Describe cross-site scripting attack, how it can occur, and the potential consequences.
78.0	Demonstrate an understanding input syntax validation. – The student will be able to:
78.01	Explain the need for validating input syntax to ensure proper input handling.
78.02	Describe canonicalization and its role in handling alternate encoding schemas.
78.03	Discuss the risks associated with improper handling of signed or unsigned numeric input (e.g., very large data length versus negative number).
79.0	Demonstrate an understanding of best practices for processing input data to ensure safe and secure program code. – The student will be able to:
79.01	Explain why any input processing algorithm must correctly handle all problem variants.
79.02	Explain why debug or test code should be removed from all production bound software.
79.03	Describe the need for ensuring that machine instructions correctly implement the intended actions of the high-level language code.
79.04	Describe the concept of a strongly typed programming language and explain its role in correct data interpretation.
79.05	Describe memory leak as it pertains to dynamically allocated memory, its causes, and potential consequences (e.g., DOS attack).
79.06	Describe the race condition associated with shared memory access, its causes, and potential consequences (e.g., DOS attack causing deadlock).

80.0	Demonstrate an understanding of the role of environment variables in the operation of software applications. – The student will be able to:
80.01	Describe how the PATH, IFS, and LD_LIBRARY_PATH environment variables can be exploited.
80.02	Explain how dynamic libraries can be subverted through the use of environment variables and describe the potential consequences (e.g., elevated privileges).
80.03	Describe the principle of “least privilege” relative to the operation of software applications, particularly as it relates to file/directory ownership management.
81.0	Demonstrate an understanding of program design strategies for inhibiting elevated privilege attacks. – The student will be able to:
81.01	Describe a Root/Admin program and explain the development and operational benefits of partitioning the program into smaller modules.
81.02	Identify the sources for confirming and tracking intrusion.
81.03	Describe the tools and methodologies used to determine the scope of data compromise.
81.04	Assess an intrusion, determine the scope of compromise, and restore compromised data.
81.05	Describe the appropriate actions related to database recovery during incidence response.

**Course Number: CTS0085**  
**Occupational Completion Point: B**  
**Web Security Specialist – 150 Hours – SOC Code 15-1122**

82.0 Demonstrate an understanding of the primary security services used in Internet and intranet environments. – The student will be able to:

82.01 Describe Secure Sockets Layer (SSL) security service.

82.02 Compare and contrast SSL with Transport Layer Security (TLS) as a security service.

82.03 Describe Internet Protocol Security (IPSec) and discuss its benefits and three functional areas (i.e., authentication, confidentiality, key management).

82.04 Describe Secure/Multipurpose Internet Mail Extension (S/MIME) and discuss its role in achieving secure Internet-based communications.

83.0 Demonstrate a fundamental understanding of the SSL protocol stack and its elements. – The student will be able to:

83.01 Compare and contrast SSL Connection and SSL Session.

83.02 Describe SSL Record Protocol services and discuss their role in managing SSL exchanges (i.e., message integrity, confidentiality).

83.03 Describe the operation of the SSL Record Protocol, including the key steps that ensure security (e.g., adding message authentication code, encryption).

83.04 Explain the role of the SSL Change Cipher Spec Protocol in ensuring secure transactions.

83.05 Explain the role of the SSL Alert Protocol.

83.06 Describe the SSL Handshake Protocol and explain the role of each phase of communication (i.e., establish security capability, server authentication/key exchange, client authentication/key exchange, complete secure connection).

84.0 Demonstrate an understanding of IPSec, including its uses, elements, and mechanisms. – The student will be able to:

84.01 Compare and contrast IPSec with SSL and TSL.

84.02 Compare and contrast security services provided under IPv4 and IPv6.

84.03 Differentiate between the three facilities available under IPSec (i.e., Authentication Header, Encapsulating Security Payload, key exchange).

84.04 Describe the concept of Security Association (SA) and explain the roles of its three parameters (i.e., Security Parameters Index, IP Destination Address, Security Protocol Identifier).

84.05 Describe the purpose, structure, and criteria of the Authentication Header (AH).

84.06 Describe the purpose, structure, and elements of the Encapsulating Security Protocol (ESP).

84.07 Describe the structure and operation of the key management facility of IPSec.



85.0	Demonstrate an understanding of S/MIME, including its uses, functions, cryptographic algorithms, and key certificates. – The student will be able to:
85.01	Describe the role of S/MIME in conducting email communications.
85.02	Compare and contrast the four new security functions provided by S/MIME (i.e., enveloped data, signed data, clear-signed data, signed and enveloped data).
85.03	Outline the process of using S/MIME during email processing.
85.04	Describe the various cryptographic algorithms used by S/MIME and discuss their applicability (i.e., DSS, RSA, SHA-1, MD5, ElGamal, AES, 3DES, HMAC).
85.05	Describe memory leak as it pertains to dynamically allocated memory, its causes, and potential consequences (e.g., DOS attack).
85.06	Describe the need for using x.509 v3 public key certificates with S/MIME.
86.0	Demonstrate an understanding of Kerberos and its role in third-part authentication in a distributed network. – The student will be able to:
86.01	Compare and contrast the roles and operation of a Kerberos Authentication Server (AS) and a Ticket Granting Server (TGS).
86.02	Describe a Kerberos realm and the mechanism for inter-realm authentication.
87.0	Demonstrate an understanding of identity management and ways in which secure identify information is exchanged across different domains. – The student will be able to:
87.01	Describe the key components of identity management architecture.
87.02	Describe the concept of identity federation and explain its benefits.
87.03	Describe the standards used in federated identity management (i.e., XML, SOAP, WS-Security, SAML).

**Course Number: CTS0089**  
**Occupational Completion Point: B**  
**Information Security Administrator – 150 Hours – SOC Code 15-1122**

88.0 Complete a safety skills inventory. – The student will be able to:

88.01 Practice safety procedures while enrolled in this course.

88.02 Demonstrate an understanding of safety and general policies and procedures.

89.0 Demonstrate acceptable project values. – The student will be able to:

89.01 Maintain a positive relationship with peers.

89.02 Demonstrate adaptive self-management skills.

89.03 Adhere to industry accepted, legal, and ethical standards of cyber conduct.

89.04 Rotate through a wide variety of increasingly responsible experiences.

89.05 Apply superior skills in communications, mathematics, and science appropriate to technological content and learning activities.

90.0 Demonstrate the ability to detect and resolve system vulnerabilities. – The student will be able to:

90.01 Prepare a vulnerability matrix to identify and record weak points, the type of vulnerability, significance of the vulnerability, the priority, and the solution.

90.02 Determine possible solutions for each vulnerability.

90.03 Research each detected vulnerability.

90.04 Document solutions as they are devised.

90.05 Prepare an alternative for any solution that is not successful.

90.06 Continue the process until a workable solution is found for each vulnerability.

91.0 Plan, organize, and carry out a penetration testing plan. – The student will be able to:

91.01 Determine the scope and attack vectors for the test.

91.02 Organize the team according to individual strengths.

91.03 Assign specific tasks within a team.

91.04 Prioritize the attack vectors and sequence the test.

91.05 Identify required resources.

91.06	Carry out the testing plan to successful completion.
91.07	Create the test report detailing the goals, tests, findings, and results.
92.0	Demonstrate proficiency in conducting forensic analysis. – The student will be able to:
92.01	Create security incident handling and response policies.
92.02	Recover deleted, encrypted, or damaged file information as evidence for prosecution in computer crimes.
92.03	Deploy proprietary and/or open source tools to identify intruder footprints.
92.04	Coordinate incident response activities.
92.05	Prepare proper documentation of chain of custody, including accounting for evidence source, destination, and possession.
92.06	Preserve forensic integrity of evidence.
92.07	Model highest moral and ethical standards in conducting digital forensic investigations.
93.0	Successfully work as a member of a team. – The student will be able to:
93.01	Accept responsibility for specific tasks in a given situation.
93.02	Document progress, and provide feedback on work accomplished in a timely manner.
93.03	Complete assigned tasks in a timely and professional manner.
93.04	Reassign responsibilities when the need arises.
93.05	Complete daily tasks as assigned on one's own initiative.
94.0	Manage time according to a plan. – The student will be able to:
94.01	Set realistic time frames and schedules.
94.02	Record time worked in the daily journal.
94.03	Meet goals and objectives set by the team.
94.04	Identify individual priorities.
94.05	Complete a weekly evaluation of accomplishments, and reevaluate goals, objectives and priorities as needed.
95.0	Keep acceptable records of progress problems and solutions. – The student will be able to:
95.01	Develop a record keeping system in the form of a log book or journal to record daily progress.

95.02	Use a project journal to identify problem statement.
95.03	Develop a portfolio of work accomplished to include design drawings, research, drawings and plans, storyboards, models, mock-ups and prototypes.
96.0	Manage resources. – The student will be able to:
96.01	Identify required resources for each stage of the project plan.
96.02	Determine the methods needed to acquire needed resources.
96.03	Demonstrate good judgment in the use of resources.
96.04	Recycle and reuse resources where appropriate.
96.05	Demonstrate an understanding of proper legal and ethical treatment of copyrighted material.
97.0	Use tools, materials, and processes in an appropriate and safe manner. – The student will be able to:
97.01	Identify the proper tool for a given job.
97.02	Use tools and machines in a safe manner.
97.03	Adhere to laboratory or job site safety rules and procedures.
97.04	Identify the application of processes appropriate to the task at hand.
97.05	Identify materials appropriate to their application.
98.0	Research content related to the project and document the results. – The student will be able to:
98.01	Identify the basic research needed to develop the project plan.
98.02	Identify available resources for completing background research required in the project plan.
98.03	Demonstrate the ability to locate resource materials in a library, data base, internet and other research resources.
98.04	Demonstrate the ability to organize information retrieval.
98.05	Demonstrate the ability to prepare a topic outline.
98.06	Write a draft of the design and testing report.
98.07	Edit and proof the respective report.
98.08	Prepare an electronically composed report in proper form.
99.0	Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience. – The student will be able to:
99.01	Prepare a multi-media presentation on the completed project.

99.02	Make an oral presentation, using multi-media materials.
99.03	Review the presentation, and make changes in the delivery method(s) to improve presentation skills.
100.0	Demonstrate competency in the area of expertise related to the Applied Cybersecurity education program previously completed that this project is based upon. – The student will be able to:
100.01	Demonstrate a mastery of the content of the selected subject area.
100.02	Demonstrate the ability to use related technological tools, materials and processes related to the specific program area.
100.03	Demonstrate the ability to apply the knowledge, experience and skill developed in the previous program completion to the successful completion of this demonstration.
100.04	Demonstrate the acquisition of additional knowledge, skill and experience in one area of the selected field of study beyond the performance standards of the initial program standards.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Cloud Computing & Virtualization  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y100400
CIP Number	0511100303
Grade Level	30, 31
Standard Length	900 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1142 – Network and Computer Systems Administrators
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as a Computer Support Assistant, Network Support Technician, Cloud Specialist, Cloud Virtualization Engineer in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to instruction in computer literacy; software application support; basic hardware configuration and troubleshooting; networking technologies, troubleshooting, security, and administration; and customer service and human relations skills.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**



This program is a planned sequence of instruction consisting of five occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	EEV0504	Computer Support Assistant	BUS ED 1 @2	150 hours	15-1151
C	CTS0026	Network Support Technician	COMPU SCI 6	150 hours	15-1142
D	CTS0054	Cloud Analyst	COMP SVC 7G	150 hours	15-1142
E	CTS0056	Cloud Virtualization Specialist	CYBER TECH 7G INFO TECH 7G	300 hours	15-1142

Note: OTA0040 is a core.

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 16.0 Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules.
- 17.0 Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment.
- 18.0 Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace.
- 19.0 Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems.
- 20.0 Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems.
- 21.0 Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked.
- 22.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, internet, remote access, or direct contact.
- 23.0 Demonstrate proficiency using graphical user interface (GUI) operating systems.

- 24.0 Demonstrate language arts knowledge and skills.
- 25.0 Demonstrate mathematics knowledge and skills.
- 26.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 27.0 Participate in work-based learning experiences.
- 28.0 Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, remote access, or direct contact.
- 29.0 Perform installation and configuration activities.
- 30.0 Demonstrate proficiency using computer networks.
- 31.0 Demonstrate proficiency in configuring and troubleshooting hardware devices and drivers.
- 32.0 Demonstrate proficiency in managing, monitoring, and optimizing system performance, reliability and availability.
- 33.0 Demonstrate proficiency in managing, configuring and troubleshooting storage use.
- 34.0 Demonstrate proficiency in configuring and troubleshooting network connections.
- 35.0 Demonstrate proficiency in implementing, monitoring, and troubleshooting security.
- 36.0 Evaluate and analyze cloud principles used in cloud computing.
- 37.0 Identify the components of cloud based services.
- 38.0 Evaluate cloud based services.
- 39.0 Use cloud-based services.
- 40.0 Evaluate and analyze techniques and methods of cloud deployment.
- 41.0 Evaluate the risks of cloud-based systems.
- 42.0 Demonstrate an awareness of cloud implementation.
- 43.0 Demonstrate an understanding of virtualization concepts.
- 44.0 Install and configure the virtualization server platform.
- 45.0 Install, configure and manage virtualized clients.
- 46.0 Demonstrate proficiency in managing a virtualization infrastructure.
- 47.0 Demonstrate an understanding of storage technologies and storage configuration.
- 48.0 Demonstrate proficiency in network optimization using network protocols, ports, and topologies.
- 49.0 Understand security in a virtualized environment.

Florida Department of Education  
Student Performance Standards

Program Title: Cloud Computing & Virtualization  
Career Certificate Program Number: Y100400

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

**Course Number: EEV0504**  
**Occupational Completion Point – B**  
**Computer Support Assistant – 150 Hours – SOC Code 15-1151**

15.0	Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. – The student will be able to:
15.01	Develop strategies for resolving customer conflicts.
16.0	Identify, install, configure, and upgrade desktop and server computer modules and peripherals, following established basic procedures for system assembly and disassembly of field replaceable modules. – The student will be able to:
16.01	Identify and describe the functions of main processing boards (e.g., CPUs, RAM, ROM, bus architecture).
16.02	Identify and describe the functions of communication ports (e.g., serial and parallel ports).
16.03	Identify and describe the functions of peripheral devices (e.g., scanners, modems, hard drives, printers).
16.04	Identify and describe the components of portable systems (e.g., battery, LCD, AC adapter, PDAs).
16.05	Troubleshoot, install and upgrade computers and peripherals.
16.06	Perform system hardware setup Demonstrate an understanding of input/output devices.
16.07	Install and configure of applications software, hardware, and device drivers.
16.08	Demonstrate an understanding of the operation and purpose of hardware components.
16.09	Install operating system software.
16.10	Customize operating systems.
16.11	Install application software.
16.12	Perform storage formatting and preparation activities.
16.13	Identify data measurement (e.g., bits, bytes, kilobytes).
16.14	Install and configure RAID.
16.15	Recognize and report on server room environmental issues (temperature, humidity/ESD/power surges, back-up).
17.0	Diagnose and troubleshoot common module problems and system malfunctions of computer software, hardware, peripherals, and other office equipment. – The student will be able to:
17.01	Troubleshoot a personal computer system.
17.02	Identify configuration problems.
17.03	Identify software problems.

17.04	Identify hardware malfunctions.
17.05	Identify network malfunctions.
17.06	Resolve computer error messages.
17.07	Understand and troubleshoot memory and cache systems.
17.08	Verify that drives are the appropriate type.
17.09	Describe knowledge database search procedures used to identify possible solutions when troubleshooting software and hardware problems.
18.0	Identify issues, procedures and devices for protection within the computing environment, including people, hardware and the surrounding workspace. – The student will be able to:
18.01	Apply basic rules for hardware safety.
18.02	Demonstrate proficiency in basic preventative hardware maintenance.
18.03	Apply special disposal procedures that comply with environmental guidelines for batteries, CRTs, toner kits/cartridges, chemical solvents and cans, and MSDS.
18.04	Apply ergonomic principles applicable to the configuration of computer workstations.
18.05	Describe ethical issues and problems associated with computers and information systems.
19.0	Identify specific terminology, facts, ways and means of dealing with classifications, categories and principles of motherboards, processors and memory in desktop and server computer systems. – The student will be able to:
19.01	Identify EDO RAM, DRAM, SRAM, RIMM, VRAM, SDRAM, and WRAM.
19.02	Identify memory banks, memory chips (8-bit, 16-bit, and 32-bit), SIMMS (Single In-line Memory Module), DIMMS (Dual In-line Memory Module), parity chips versus non-parity chips.
19.03	Identify printer parallel port, COM/serial port, floppy drive, hard drive, Memory, and Boot sequence.
20.0	Demonstrate knowledge of basic types of printers, basic concepts, printer components, how they work, how they print onto a page, paper path, care and service techniques, and common problems. – The student will be able to:
20.01	Identify types of printers—Laser, Inkjet, Dot Matrix.
20.02	Identify care and service techniques and common problems with primary printer types.
20.03	Implement and manage printing on a network.
21.0	Identify and describe basic network concepts and terminology, ability to determine whether a computer is networked, knowledge of procedures for swapping and configuring network interface cards, and knowledge of the ramifications of repairs when a computer is networked. – The student will be able to:

21.01	Define networking and describe the purpose of a network.
21.02	Identify the purposes and interrelationships among the major components of networks (e.g., servers, clients, transmission media, network operating system, network boards).
21.03	Describe the various types of network topologies.
21.04	Identify and describe the purpose of standards, protocols, and the Open Systems Interconnection (OSI) reference model.
21.05	Configure network and verify network connectivity.
21.06	Discuss the responsibilities of the network administrator (e.g., rights and responsibilities).
21.07	Develop user logon procedures.
21.08	Utilize network management infrastructures (e.g., network monitoring, alerting, security) to perform administrative tasks.
21.09	Identify common backup strategies and procedures.
21.10	Select and use appropriate electronic communications software and hardware for specific tasks.
21.11	Compare and contrast Internet software and protocols.
21.12	Diagnose and resolve electronic communications operational problems.
21.13	Design and implement directory tree structures.
21.14	Install services tools (SNMP, backup software).
21.15	Perform full backup and verify backup.
21.16	Identify bottlenecks (e.g., processor, bus transfer, I/O, disk I/O, network I/O, memory).
21.17	Use the concepts of fault tolerance/fault recovery to create a disaster recovery plan.
21.18	Document and test disaster recovery plan regularly, and update as needed.
22.0	Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, internet, remote access, or direct contact. – The student will be able to:
22.01	Apply call center vocabulary.
22.02	Listen and input information simultaneously.
22.03	Apply first response assistance for minor repair work.
23.0	Demonstrate proficiency using graphical user interface (GUI) operating systems. – The student will be able to:
23.01	Identify parts of GUI windows.



23.02	Create and use icons.
23.03	Demonstrate proficiency in using menu systems.
23.04	Demonstrate proficiency in using pointing and selection devices.
23.05	Identify keyboard shortcuts and special function keys.
23.06	Demonstrate proficiency in manipulating windows.
23.07	Utilize help systems and hypertext links.
23.08	Create, organize, and maintain file system directories.
23.09	Organize desktop objects.
23.10	Run multiple applications.
24.0	Demonstrate language arts knowledge and skills. – The student will be able to:
24.01	Locate, comprehend and evaluate key elements of oral and written information.
24.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
24.03	Present information formally and informally for specific purposes and audiences.
25.0	Demonstrate mathematics knowledge and skills. – The student will be able to:
25.01	Demonstrate knowledge of arithmetic operations.
25.02	Analyze and apply data and measurements to solve problems and interpret documents.
25.03	Construct charts/tables/graphs using functions and data.

**Course Number: CTS0026**  
**Occupational Completion Point – C**  
**Network Support Technician – 150 Hours – SOC Code 15-1142**

26.0	Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance. – The student will be able to:
26.01	Develop diplomatic methods to communicate with customers.
27.0	Participate in work-based learning experiences. – The student will be able to:
27.01	Participate in work-based learning experiences in a network support services environment.
27.02	Discuss the use of technology in a network environment.
28.0	Perform end user support and assistance by troubleshooting and diagnosing through telephone, e-mail, remote access, or direct contact. – The student will be able to:
28.01	Apply first response assistance for minor repair work.
29.0	Perform installation and configuration activities. – The student will be able to:
29.01	Configure the operating system environment.
29.02	Connect client workstation running similar operating system to the network.
29.03	Configure Internet access for a network.
29.04	Configure a web server.
29.05	Use remote server to deploy operating system.
29.06	Troubleshoot failed installations.
29.07	Install and configure network services for interoperability.
29.08	Monitor, configure, troubleshoot and control access to printers.
29.09	Monitor, configure, troubleshoot and control access to files, folders, and shared folders.
29.10	Monitor, configure, troubleshoot and control access to websites.
30.0	Demonstrate proficiency using computer networks. – The student will be able to:
30.01	Identify and describe the purpose of standards; protocols; and the Open Systems Interconnection (ISO) reference model.
31.0	Demonstrate proficiency in configuring and troubleshooting hardware devices and drivers. – The student will be able to:
31.01	Configure hardware devices.
31.02	Configure driver signing options.

	31.03 Update device drivers.
	31.04 Troubleshoot problems with hardware.
32.0	Demonstrate proficiency in managing, monitoring, and optimizing system performance, reliability and availability. – The student will be able to:
	32.01 Monitor and optimize usage of system resources.
	32.02 Manage processes.
	32.03 Optimize disk performance.
	32.04 Manage and optimize availability of system data and user data.
	32.05 Recover systems and user data.
33.0	Demonstrate proficiency in managing, configuring and troubleshooting storage use. – The student will be able to:
	33.01 Configure and manage user profiles.
	33.02 Monitor, configure and troubleshoot disks and volumes.
	33.03 Configure data compression.
	33.04 Monitor and configure disk quotas.
	33.05 Recover from disk failures.
34.0	Demonstrate proficiency in configuring and troubleshooting network connections. – The student will be able to:
	34.01 Install, configure and troubleshoot shared access.
	34.02 Install, configure and troubleshoot a virtual private network.
	34.03 Install, configure and troubleshoot network protocols.
	34.04 Install and configure network services.
	34.05 Configure, monitor and troubleshoot remote access.
	34.06 Install, configure, monitor and troubleshoot Terminal Services.
	34.07 Configure the properties of a connection.
	34.08 Install, configure and troubleshoot network adapters and drivers.
35.0	Demonstrate proficiency in implementing, monitoring, and troubleshooting security. – The student will be able to:

35.01	Encrypt data on a hard disk by using Encrypting File System.
35.02	Implement, configure, manage and troubleshoot policies in an operating system environment.
35.03	Implement, configure, manage and troubleshoot auditing.
35.04	Implement, configure, manage and troubleshoot local accounts.
35.05	Implement, configure, manage and troubleshoot account policy.
35.06	Implement, configure, manage and troubleshoot security by using the Security Configuration Tool Set.

**Course Number: CTS0054**  
**Occupational Completion Point – D**  
**Cloud Analyst – 150 Hours SOC Code 15-1142**

36.0 Evaluate and analyze cloud principles used in cloud computing. – The student will be able to:

36.01 Demonstrate understanding of the evolution of cloud computing.

36.02 Compare and contrast drivers and limitations of cloud computing.

36.03 Compare and contrast the four main deployment models for cloud computing, public, private, community, and hybrid.

36.04 Describe the three main service models for cloud computing (SaaS, PaaS, and IaaS).

36.05 Describe the role of the Internet and virtualization in cloud computing.

36.06 Understand and identify managed services in cloud computing.

37.0 Identify the components of cloud based services. – The student will be able to:

37.01 Demonstrate proficiency in accessing web applications through web browser.

37.02 Describe, identify and use thin clients to complete business tasks.

37.03 Describe, identify and use thick clients to complete business tasks.

37.04 Describe, identify and use mobile clients to complete business tasks.

37.05 Demonstrate an awareness of application hosting.

37.06 Demonstrate an awareness of multipurpose architecture.

38.0 Evaluate cloud based services. – The student will be able to:

38.01 Perform calculations to identify the costs and savings of different cloud based models for an organization.

38.02 Compare and contrast cloud based services used in industry.

38.03 Identify the impacts to current and future staffing and operational needs.

38.04 Evaluate performance of cloud-based solutions using performance indicators.

39.0 Use cloud-based services. – The student will be able to:

39.01 Compare and contrast outsourcing and cloud computing as alternatives for business.

39.02 Identify and use cloud based services to improve productivity.

39.03	Compare and contrast cloud based services for consumer and business.
39.04	Use cloud based services to perform collaboration online.
39.05	Demonstrate an awareness of the user experience in using a cloud-based service as compared to traditional business model.
40.0	Evaluate and analyze techniques and methods of cloud deployment. – The student will be able to:
40.01	Demonstrate an awareness of networking for cloud-based solutions.
40.02	Demonstrate an awareness of the role of automation and self-service in regard to cloud-based solutions.
40.03	Demonstrate an awareness of deployment and management of internal and external cloud services to complete business task.
40.04	Demonstrate an awareness of the role standardization in cloud-based solutions.
40.05	Demonstrate the impact of time to market, distribution over the Internet in cloud deployment.
41.0	Evaluate the risks of cloud-based systems. – The student will be able to:
41.01	Identify and evaluate compliance risks relating to software and vendors in cloud-based systems.
41.02	Demonstrate an understanding of user privacy rights and privacy risks in cloud-based systems.
41.03	Demonstrate an understanding of legal risks in cloud based systems.
41.04	Understand the role of vendors and dependencies in cloud-based solutions.
41.05	Demonstrate an understating of the risks of hardware independence.
41.06	Identify the main aspects of identity management.
42.0	Demonstrate an awareness of cloud implementation. – The student will be able to:
42.01	Describe the use of a Virtual Private network access to Local Area Network.
42.02	Describe the risk of connecting a local cloud network to the public Internet.
42.03	Identify and describe the components of cloud environment.
42.04	Demonstrate an understanding of networking topologies in cloud environment.
42.05	Demonstrate an understanding of serves, switches, and routers in cloud-based architecture.
42.06	Demonstrate an understanding of the role of the datacenter in cloud-based architecture.

**Course Number: CTS0056**  
**Occupational Completion Point – E**  
**Cloud Virtualization Specialist – 300 Hours – SOC Code 15-1142**

43.0 Demonstrate an understanding of virtualization concepts. – The student will be able to:

43.01 Demonstrate an understanding of the role of the virtual CPU in virtualization.

43.02 Demonstrate an understanding of the role of virtual memory in virtual component.

43.03 Demonstrate an understanding of system patching for virtual environment.

43.04 Demonstrate an understanding of virtual desktops.

43.05 Evaluate the components of networking topology including (servers, network, storage).

43.06 Compare and contrast traditional desktops and servers to virtual counterpart.

43.07 Demonstrate an understanding of the hardware requirements to create and scale a virtual infrastructure.

43.08 Demonstrate the differences between traditional virtualization and para-virtualization.

43.09 Identify, describe and use guest operating system in a virtualization environment.

43.10 Identify, define and use virtual machine monitor in virtual environment.

43.11 Perform virtual partitioning through the Hypervision.

43.12 Demonstrate an awareness of the bare metal approach for virtualization portioning.

43.13 Demonstrate an awareness of hosted virtualization as a virtualization approach.

43.14 Understand and use industry standards for hardware support for virtualization.

43.15 Demonstrate an understanding of high-level language virtual machines.

43.16 Describe the benefits of server consolidation and containment acquired through migration to virtualization.

43.17 Describe the benefits of test and development optimization gained through virtualization.

43.18 Demonstrate how virtualization reduces cost and complexity of high availability and disaster recovery.

43.19 Demonstrate how virtualization can enhance security in the enterprise.

44.0 Install and configure the virtualization server platform. – The student will be able to:

44.01 Demonstrate an understanding of a virtual image and compare that to a golden image.

44.02 Create a virtual image using a virtualization platform using a base operating system.

44.03	Create a virtual template in which the golden image is configured with the software packages and application.
44.04	Configure the virtual template to ensure software settings and organizational policies are implemented.
44.05	Manage inventory objects licenses using the virtual infrastructure ensure to comply with enterprise requirements.
44.06	Demonstrate how a virtual switch is used to create communication between virtual machines.
44.07	Perform communication between two virtual machines through the use of a virtual switch.
44.08	Create, manage and configure virtual switches to enable communication of virtual machines in different hosts.
44.09	Use virtual system management to remotely manage the allocation in a virtual network.
44.10	Perform and manage user roles and permission in a virtual environment.
44.11	Perform server patching on a virtual environment both on traditional servers as well virtual servers.
44.12	Create a patching baseline.
45.0	Install, configure and manage virtualized clients. – The student will be able to:
45.01	Demonstrate an awareness of peripheral redirection.
45.02	Demonstrate proficiency in configuring virtual client to enable both USB and monitor redirection.
45.03	Compare and contrast the use of peripherals in a traditional and virtual environment.
45.04	Demonstrate an understanding of the types of virtual clients used in a virtualization infrastructure.
45.05	Demonstrate proficiency in performing tasks using thin, thick and mobile virtualization clients.
45.06	Compare and contrast the performance, ease of use and efficiency of different clients in completing business tasks.
45.07	Analyze business tasks that are better aligned to a particular virtualization client type.
45.08	Demonstrate proficiency in managing user sessions and policies of virtual clients.
46.0	Demonstrate proficiency in managing a virtualization infrastructure. – The student will be able to:
46.01	Demonstrate an understanding of the process of cloning virtual machines.
46.02	Identify the benefits of cloning in a virtual infrastructure.
46.03	Compare and contrast full clones and linked clones.
46.04	Demonstrate proficiency in identifying situations in which cloning is a proper solution.



46.05	Demonstrate proficiency in deploying virtual machines using cloning.
46.06	Demonstrate an understating of virtual migration.
46.07	Demonstrate an understanding of the situational needs that require a virtual migration.
46.08	Identify the role of network bandwidth and resource allocation needed for virtual migration.
46.09	Demonstrate an understanding of automating migration to the host server.
46.10	Identify the process that migration affect virtual disk storage in particular SANS.
46.11	Demonstrate proficiency in developing action steps to execute a virtual migration.
47.0	Demonstrate an understanding of storage technologies and storage configuration. – The student will be able to:
47.01	Demonstrate an awareness of the evolution of storage architecture and data center components.
47.02	Describe, identify and use data center elements host, connectivity and storage.
47.03	Identify describe, and use RAID technology in an enterprise environment.
47.04	Identify the impact to application performance based on RAID implementation.
47.05	Demonstrate an awareness of intelligent storage system.
47.06	Compare and contrast storage systems for a virtualization infrastructure.
47.07	Demonstrate an awareness of storage network technologies (Fibre Channel Storage Network FC Scan, IP Scan, Fibre Channel over Ethernet, Network Attached Storage, Object Based, Unified Storage).
47.08	Identify the appropriate storage network solutions based on client requirements.
47.09	Demonstrate proficiency in creating and managing data stores.
47.10	Demonstrate proficiency in configuring and managing resource pools.
48.0	Demonstrate proficiency in network optimization using network protocols, ports, and topologies. – The student will be able to:
48.01	Demonstrate an awareness of disaster recovery (business continuity) information availability for virtualized and non-virtualized environments.
48.02	Demonstrate proficiency in backup and recovery in both virtualized and non-virtualized environments.
48.03	Demonstrate an awareness of deduplication technology for backup optimization.
48.04	Demonstrate an awareness of fixed content storage requirements and archival solutions.
48.05	Demonstrate an awareness of continuous data replication and remote replication in virtualized and non-virtualized environments.

48.06	Demonstrate proficiency in integrating Active Directory to a virtual environment.
48.07	Demonstrate proficiency in CPU and memory optimization.
48.08	Demonstrate proficiency using remote desktops and display protocols to optimize network infrastructure.
48.09	Demonstrate an awareness of fault tolerance and acceptable levels tolerated based on the infrastructure.
49.0	Understand security in a virtualized environment. – The student will be able to:
49.01	Compare and contrast hosted and Bare-Metal virtualization implementations vulnerability to threats and attacks.
49.02	Demonstrate an awareness of data leakage and malicious code intrusion.
49.03	Demonstrate proficiency in securing data between guest and host environments.
49.04	Demonstrate proficiency in managing resource allocation in a virtualized environment to reduce system crash.
49.05	Demonstrate proficiency in creating images that are secure for client deployment.
49.06	Demonstrate an awareness of software security levels and digital signatures.
49.07	Demonstrate proficiency in using, configuring and managing host firewall in a virtualized infrastructure.
49.08	Demonstrate proficiency in using command line to configure and manage the host firewall.
49.09	Demonstrate proficiency in using logging tools to monitor activity in the virtual environment.
49.10	Identify, describe and provide solutions to threats based on scalability and high availability.
49.11	Demonstrate proficiency in securing mobile, thin and thick clients.
49.12	Demonstrate an awareness of threats to network authentication in a virtualized environment.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Database and Programming Essentials  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y300100
CIP Number	0511080207
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1141 – Database Administrators
Basic Skills Level	Mathematics: 11 Language: 11 Reading: 11

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and entry-level database and internet/web related careers; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, and technical skills related to database and Internet technologies skills using the latest industry tools. This curriculum is project-based and modeled after the Oracle Academy.

**Additional Information** related to this Career and Technical Education (CTE) program is provided at the end of this document.

## Program Structure

This program is a planned sequence of instruction consisting of one occupational completion point. It is recommended that students complete Algebra I and a programming/flow-charting course concurrently or prior to taking this program.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
	CTS0046	Database Fundamentals	BUS ED 1 @2	150 hours	15-1141
	CTS0047	Specialized Database Programming	COMPU SCI 6	150 hours	15-1141
	CTS0067	Specialized Database Applications	COMP PROG 7G	150 hours	15-1141

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Develop an awareness of the changes taking place in the information age and how they fit into an evolving society.
- 16.0 Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs.
- 17.0 Develop the process of creating an entity by identifying relationships.
- 18.0 Formulate and assemble initial entity relationship by expanding on modeling concepts.
- 19.0 Consider the degree and optionality of relationships of entities.
- 20.0 Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and Many-to-Many (M:M) relationships for building entity relationship diagrams.
- 21.0 Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships.
- 22.0 Demonstrate proficiency in designing and adding complexity to a logical relationship.
- 23.0 Apply the complex logical information by fine tuning entities and the process for relating them.
- 24.0 Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved.
- 25.0 Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion of mistakes.
- 26.0 Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data.
- 27.0 Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database.
- 28.0 Extend the logical presentation model by normalizing the data and mapping the management system.
- 29.0 Apply techniques for building a storage management system by creating a website using templates and wizards.



- 30.0 Demonstrate storage closet design and functionality by constructing a group business presentation.
- 31.0 Demonstrate comprehension of database modeling competency through group presentation.
- 32.0 Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints.
- 33.0 Demonstrate comprehension of aspects of SQL Language interface by writing basic SQL statements.
- 34.0 Demonstrate proficiency working with columns, characters, and rows in SQL.
- 35.0 Demonstrate proficiency in using SQL comparison operators.
- 36.0 Demonstrate proficiency in using logical comparisons and precedence rules.
- 37.0 Demonstrate proficiency using SQL single row functions.
- 38.0 Demonstrate proficiency displaying data from multiple tables.
- 39.0 Demonstrate proficiency aggregating data using GROUP functions.
- 40.0 Demonstrate proficiency utilizing subqueries.
- 41.0 Demonstrate proficiency producing readable output with SQL language interface, reporting tool and manipulating data.
- 42.0 Demonstrate proficiency creating and managing database objects.
- 43.0 Demonstrate proficiency altering tables and constraints implementing views.
- 44.0 Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects.
- 45.0 Demonstrate ability to control user access and SQL language interface and reporting tool.
- 46.0 Demonstrate comprehension of bundling features of SQL.
- 47.0 Demonstrate comprehension working with composite data types by writing executable script files.
- 48.0 Describe the differences between SQL and PL/SQL.
- 49.0 Create SQL blocks.
- 50.0 Use variables in PL/SQL.
- 51.0 Recognize lexical units.
- 52.0 Recognize data types.
- 53.0 Use scalar data types.
- 54.0 Use various types of joins.
- 55.0 Use SQL group functions and subqueries.
- 56.0 Write SQL executable statements.
- 57.0 Use nested blocks and variable scope.
- 58.0 Use good programming practices.
- 59.0 Write DML statements to manipulate data.
- 60.0 Retrieve data using SQL.
- 61.0 Manipulate data using SQL.
- 62.0 Use transaction control statements.
- 63.0 Use IF conditional control statements.
- 64.0 Use CASE conditional control statements.
- 65.0 Use basic loop iterative control statements.
- 66.0 Use WHILE and FOR loop iterative control statements.
- 67.0 Use nested loop iterative control statements.
- 68.0 Use explicit cursors.
- 69.0 Use explicit cursor attributes.
- 70.0 Use cursor for loops.

- 71.0 Use cursors with parameters.
- 72.0 Use cursors for update transactions.
- 73.0 Use multiple cursors.
- 74.0 Handle exceptions.
- 75.0 Trap database server exceptions.
- 76.0 Trap user-defined exceptions.
- 77.0 Create procedures.
- 78.0 Use parameters in procedures.
- 79.0 Pass parameters.
- 80.0 Create stored functions.
- 81.0 Use functions in SQL statements.
- 82.0 Manage procedures and functions.
- 83.0 Manage object privileges.
- 84.0 Use invoker's rights.
- 85.0 Create packages.
- 86.0 Manage package constructs.
- 87.0 Use advanced package concepts.
- 88.0 Manage persistent state of package variables.
- 89.0 Use vendor-supplied packages.
- 90.0 Understand dynamic SQL.
- 91.0 Understand triggers.
- 92.0 Create DML triggers.
- 93.0 Create DDL and database event triggers.
- 94.0 Manage triggers.
- 95.0 Use large object data types.
- 96.0 Manage binary types.
- 97.0 Manage indexes.
- 98.0 Manage dependencies.
- 99.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 100.0 Solve problems using critical thinking skills, creativity and innovation.
- 101.0 Use information technology tools.
- 102.0 Describe the roles within teams, work units, departments, organizations, interorganizational systems, and the larger environment.
- 103.0 Describe the importance of professional ethics and legal responsibilities.
- 104.0 Understand network systems.
- 105.0 Program a database application.
- 106.0 Utilize the basic concepts of database design.
- 107.0 Utilize SQL and UNION queries.
- 108.0 Implement program statements using objects.
- 109.0 Utilize debugging tools and write error handlers.
- 110.0 Demonstrate file I/O.
- 111.0 Create forms and identify all the properties of a form.
- 112.0 Manipulate data using object models.

- 113.0 Develop custom controls.
- 114.0 Utilize API functions.
- 115.0 Demonstrate database replication and implement database replication using programming tools.
- 116.0 Analyze and implement security options.
- 117.0 Implement client/server applications.
- 118.0 Optimize the performance of a database.
- 119.0 Perform application distribution.
- 120.0 Test and debug databases.
- 121.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 122.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 123.0 Explain the importance of employability skill and entrepreneurship skills.
- 124.0 Responsible use of technology and information.

Florida Department of Education  
Student Performance Standards

Program Title: Database and Programming Essentials  
Career Certificate Program Number: Y300100

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

**Course Number: CTS0046**  
**Occupational Completion Point: A**  
**Database Fundamentals – 150 Hours – SOC Code 15-1141**

15.0	Develop an awareness of the changes taking place in the information age and how they fit into an evolving society. – The student will be able to:
15.01	Cite examples of jobs, salary, and opportunities he/she will have as a result of participating in the Academy.
15.02	Describe the role a database plays in a business and predict its evolution.
15.03	Demonstrate the difference between "data" and "information."
15.04	Understand the importance of clear communication when discussing business informational requirements.
15.05	Identify important historical contributions in database development and design.
16.0	Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs. – The student will be able to:
16.01	Identify and analyze the phases of the database development process.
16.02	Explain what conceptual data modeling and database design involve.
16.03	Compare database development process with that of the application development process.
16.04	Distinguish between a conceptual model and a physical implementation.
17.0	Develop the process of creating an entity by identifying relationships. – The student will be able to:
17.01	Identify and model various types of entities.
17.02	Identify naming and drawing conventions for entities.
17.03	Sequence the steps that are necessary for creation of an entity.
17.04	Analyze and model the relationships between entities.
18.0	Formulate and assemble initial entity relationship by expanding on modeling concepts. – The student will be able to:
18.01	Analyze and model attributes.
18.02	Identify unique identifiers for each entity.
18.03	Develop an entity relationship diagram tagging attributes with optionality.
19.0	Consider the degree and optionality of relationships of entities. – The student will be able to:
19.01	Create entity relationship models based on information requirements and interviews.
19.02	Differentiate between one-to-many, many-to-many and one-to-one relationships.

19.03	Identify relationship between two entities by reading a given diagram.
19.04	Create a relationship between instances of the same entity.
19.05	Read an entity relationship model in order to validate it.
20.0	Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams. – The student will be able to:
20.01	Identify the significance of an attribute that has more than one value for each entity instance.
20.02	Evaluate appropriate methods of storing validation rules for attributes.
20.03	Recognize unique identifiers inherited from other entities.
20.04	Sequence the steps involved in resolving a many-to-many relationship.
21.0	Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships. – The student will be able to:
21.01	Validate that an attribute is properly placed based upon its dependence on its entity's unique identifier (UID).
21.02	Resolve many-to-many relationships with intersection entities.
21.03	Model advanced data constructs including recursive relationships, subtypes, and exclusive relationships.
21.04	Create exclusive entities and relationships by using subtypes and arcs, respectively.
21.05	Identify initial layout for presentation and generate a list of action items for members of group.
21.06	Develop an entity relationship model using subtypes, supertypes and an exclusive arc.
22.0	Demonstrate proficiency in designing and adding complexity to a logical relationship. – The student will be able to:
22.01	Revise an entity relationship model according to the diagramming techniques covered in this course.
22.02	Define and give examples of hierarchical and recursive relationships.
22.03	Differentiate between transferable and non-transferable relationships.
22.04	Deliver a professional, formal business style presentation.
22.05	Evaluate and critique presentation layout, design and performance.
22.06	Construct a model using both recursion and hierarchies to express the same conceptual meaning.
22.07	Distinguish between using date as an attribute and DAY as an entity.
23.0	Apply complex logical information by fine-tuning entities and the process for relating them. – The student will be able to:
23.01	Describe a relational database and how it differs from other database systems.

23.02	Define primary keys and foreign keys and describe their purpose.
23.03	Describe what data integrity refers to and list some constraints.
23.04	Explain how database design fits into the database development process.
23.05	Translate an entity-relationship model into a relational database design.
24.0	Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved. – The student will be able to:
24.01	Demonstrate ability to implement steps for mapping entity relationship models.
24.02	Document an initial database design on table instance charts.
24.03	Recognize raw data and evaluate the steps for creating a data group in unnormalized form.
25.0	Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion or mistakes. – The student will be able to:
25.01	Differentiate between normalized and unnormalized data.
25.02	Move data from an unnormalized form through to a third normal form.
25.03	Demonstrate ability to test data groups for third normal form compliance.
25.04	Identify optimized data groups from given groups of normalized data.
26.0	Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data. – The student will be able to:
26.01	Compare the normalization and logical techniques in terms of strengths and weaknesses.
26.02	Further define normalization and explain its benefits.
26.03	Place tables in third normal form.
26.04	Explain how conceptual data modeling rules ensure normalized tables.
26.05	Specify referential integrity constraints and design indexes.
27.0	Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database. – The student will be able to:
27.01	Evaluate the transformation of business requirements into an initial layout and design for a database.
27.02	Construct simple webpage design for personal work folder.
27.03	Evaluate existing websites and determine quality of design.
28.0	Extend the logical presentation model by normalizing the data and mapping the management system. – The student will be able to:
28.01	Formulate a plan of action for the Database Project using skills previously learned in this course.

28.02	Normalize a logical to the third normal form (3NF).
28.03	Create a table in the database using a database authoring tool.
28.04	Demonstrate ability to edit tables using a database authoring tool.
28.05	Create forms that will display the table components created with a database authoring tool.
29.0	Apply techniques for building a storage management system by creating a website using templates and wizards. – The student will be able to:
29.01	Create a website that displays the database project home.
29.02	Link a website to create a web-enabled interface to the industry database.
29.03	Edit the forms created and specify appropriate field labels for data entry.
30.0	Demonstrate storage closet design and functionality by constructing a group business presentation. – The student will be able to:
30.01	Evaluate and generate criteria for a formal, business presentation.
30.02	Construct a persuasive group presentation using the guidelines set forth in class.
31.0	Demonstrate comprehension of database modeling competency through group presentation. – The student will be able to:
31.01	Deliver a formal business presentation for the class that discusses an entity-relationship model and initial database design.
31.02	Demonstrate the functionality of the database and the layout/design capabilities of a database authoring tool.
31.03	Self-assess learning experience through the presentation and demonstration of their final database project.
31.04	Prepare appropriate end user documentation.
32.0	Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints. – The student will be able to:
32.01	Identify the structural elements of a relational database table.
32.02	List and describe the system development life cycle.
32.03	Describe the industry implementation of the relational database management system (RDBMS) and object relational database management system (ORDBMS).
32.04	Explain how SQL and languages that extend SQL are used in the industry product set.
32.05	Identify the advantages of a database management system.
33.0	Demonstrate comprehension of aspects of SQL language interface by writing basic SQL statements. – The student will be able to:
33.01	List the capabilities of SQL SELECT statements.
33.02	Execute a basic select statement.



33.03	Differentiate between SQL statements and language commands that extend SQL.
34.0	Demonstrate proficiency working with columns, characters, and rows in SQL. – The student will be able to:
34.01	Apply the concatenation operator to link columns to other columns, arithmetic expressions, or constant values to create a character expression.
34.02	Use column aliases to rename columns in the query result.
34.03	Eliminate duplicate rows in the query result.
34.04	Display the structure of a table.
34.05	Apply SQL syntax to restrict the rows returned from a query.
34.06	Demonstrate application of the WHERE clause syntax.
34.07	Construct and produce output using a SQL query containing character strings and date values.
35.0	Demonstrate proficiency in using SQL comparison operators. – The student will be able to:
35.01	Apply the proper comparison operator to return a desired result.
35.02	Demonstrate proper use of BETWEEN, IN, and LIKE conditions to return a desired result.
35.03	Distinguish between zero and the value of NULL as unavailable, unassigned, unknown, or inapplicable.
35.04	Explain the use of comparison conditions and NULL.
36.0	Demonstrate proficiency in using logical comparisons and precedence rules. – The student will be able to:
36.01	Evaluate logical comparisons to restrict the rows returned based on two or more conditions.
36.02	Apply the rules of precedence to determine the order in which expressions are evaluated and calculated.
36.03	Construct a query to order a results set for single or multiple columns.
36.04	Construct a query to sort a results set in ascending or descending order.
37.0	Demonstrate proficiency using SQL single row functions. – The student will be able to:
37.01	Perform calculations on data.
37.02	Modify individual data items.
37.03	Use character, number and date functions in SELECT statements.
37.04	Format data and numbers for display purposes.
37.05	Convert column data types.

38.0	Demonstrate proficiency displaying data from multiple tables. – The student will be able to:
38.01	Construct select statements to access data from more than one table using equality and non-equality joins.
38.02	Use outer joins through viewing data that generally does not meet a join condition.
38.03	Join a table to itself.
39.0	Demonstrate proficiency aggregating data using GROUP functions. – The student will be able to:
39.01	Identify the available group functions and describe their use.
39.02	Demonstrate the ability to group data through the use of the GROUP BY clause.
39.03	Demonstrate the ability to include or exclude grouped rows by using the HAVING clause.
40.0	Demonstrate proficiency utilizing subqueries. – The student will be able to:
40.01	Write a query with an embedded subquery.
40.02	Evaluate and perform a multiple-column subquery.
40.03	Describe and explain the behavior of subqueries when null values are retrieved.
40.04	Create a subquery in a FROM clause.
41.0	Demonstrate proficiency producing readable output with SQL language interface, reporting tool, and data manipulation language. – The student will be able to:
41.01	Produce queries that require an input variable.
41.02	Customize the SQL language interface and reporting environment using SET commands for control.
41.03	Produce more readable output through the use of the column and break commands.
41.04	Describe data manipulation language (DML) and describe various DML statements.
41.05	Utilize data manipulation language (DML) through inserting, updating and deleting rows from a table.
41.06	Control transactions using COMMIT and ROLLBACK statements.
42.0	Demonstrate proficiency creating and managing database objects. – The student will be able to:
42.01	Describe the main database objects.
42.02	Create tables and alter their definitions.
42.03	Describe the data types that can be used when specifying column definition.
43.0	Demonstrate proficiency altering tables and constraints implementing views. – The student will be able to:

43.01	Create, drop, rename and truncate tables using SQL.
43.02	Identify and describe various constraints including not null, unique, primary key, foreign key, and check.
43.03	Create and maintain constraints including adding, dropping, enabling, disabling, and cascading.
43.04	Recognize views and explain how they are created, how they retrieve data and how they perform DML operations.
44.0	Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects. – The student will be able to:
44.01	Create views, retrieve data through a view, alter the definition of a view and drop a view.
44.02	Categorize information by using Top-N queries to retrieve specified data.
44.03	Identify the features of a sequence and display sequence values using a data dictionary view.
44.04	Identify the characteristics of a cached sequence.
44.05	Modify and remove a sequence using a SQL statement.
44.06	Identify the features of private and public synonyms.
44.07	Identify characteristics of an index and describe different types.
44.08	Create and remove an index using a SQL statement.
45.0	Demonstrate ability to control user access and SQL language interface and reporting tool. – The student will be able to:
45.01	Identify the features of database security.
45.02	Create users using SQL statements.
45.03	Grant and revoke object privileges using a SQL language interface and reporting tool.
46.0	Demonstrate comprehension of bundling features of SQL. – The student will be able to:
46.01	List and describe the benefits of extensions to SQL.
46.02	Recognize the basic SQL block and its sections.
46.03	Declare SQL variables and describe their significance.
46.04	Execute a SQL block.
47.0	Demonstrate comprehension working with composite data types by writing executable script files. – The student will be able to:
47.01	Recognize the significance of the executable section and decide when to use it.
47.02	Write statements in the executable section.
47.03	Describe the rules of nested blocks.

47.04 Identify and utilize appropriate coding conventions.

47.05 Create a script that will insert, update, merge and delete data in a table.

**Course Number: CTS0047**  
**Occupational Completion Point: A**  
**Specialized Database Programming – 150 Hours – SOC Code 15-1141**

48.0 Describe the differences between SQL and PL/SQL. – The student will be able to:

48.01 Describe PL/SQL.

48.02 Differentiate between SQL and PL/SQL.

48.03 Explain the need for and benefits of PL/SQL.

49.0 Create SQL blocks. – The student will be able to:

49.01 Describe the structure of a SQL block.

49.02 Identify the different types of SQL blocks.

49.03 Identify SQL programming environments.

49.04 Create and execute an anonymous block.

49.05 Output messages in PL/SQL.

50.0 Use variables in PL/SQL. – The student will be able to:

50.01 Describe how variables are used in PL/SQL.

50.02 Identify the syntax for using variables.

50.03 Declare and initialize variables.

50.04 Assign new values to variables.

51.0 Recognize lexical units. – The student will be able to:

51.01 Describe the types of lexical units in PL/SQL.

51.02 Describe identifiers and identify valid and invalid identifiers.

51.03 Describe and identify reserved words, delimiters, literals, and comments.

52.0 Recognize data types. – The student will be able to:

52.01 Describe the data type categories.

52.02 Give examples of scalar, composite, and large object (LOB) data types.

52.03 Identify when an object becomes eligible for garbage collection.

53.0 Use scalar data types. – The student will be able to:

53.01	Declare and use scalar data types.
53.02	Define guidelines for declaring and initializing variables.
53.03	Describe the benefits of anchoring data types with the %TYPE attribute.
54.0	Use various types of joins. – The student will be able to:
54.01	Construct and execute SELECT statements using an equijoin.
54.02	Construct and execute SELECT statements using a non-equijoin.
54.03	Construct and execute SELECT statements using an outer join.
54.04	Construct and execute SELECT statements that result in a cross join.
55.0	Use SQL group functions and subqueries. – The student will be able to:
55.01	Construct and execute an SQL query using group functions to determine a sum total, an average amount, and a maximum value.
55.02	Construct and execute an SQL query that groups data based on specified criteria.
55.03	Construct and execute an SQL query that contains a WHERE clause using a single-row subquery.
55.04	Construct and execute an SQL query that contains a WHERE clause using a multiple-row subquery.
56.0	Write SQL executable statements. – The student will be able to:
56.01	Construct variable assignment statements.
56.02	Construct statements using built-in SQL functions.
56.03	Differentiate between implicit and explicit data type conversions.
56.04	Describe when implicit data type conversions take place.
56.05	List the drawbacks of implicit data type conversions.
56.06	Construct statements using functions to explicitly convert data types.
56.07	Construct statements using operators.
57.0	Use nested blocks and variable scope. – The student will be able to:
57.01	Understand the scope and visibility of variables.
57.02	Write nested blocks and qualify variables with labels.
57.03	Describe the scope of an exception.
57.04	Describe the effect of exception propagation in nested blocks.

58.0	Use good programming practices. – The student will be able to:
58.01	List examples of good programming practices.
58.02	Insert comments into SQL code.
58.03	Follow formatting guidelines when writing code.
59.0	Write DML statements to manipulate data. – The student will be able to:
59.01	Construct and execute a DML statement to insert data into a table.
59.02	Construct and execute a DML statement to update data in a table.
59.03	Construct and execute a DML statement to delete data from a table.
59.04	Construct and execute a DML statement to merge data into a table.
60.0	Retrieve data using PL/SQL. – The student will be able to:
60.01	Identify SQL statements that can be directly included in an executable block.
60.02	Construct and execute an INTO clause to hold values returned by a single-row SELECT statement.
60.03	Construct statements that retrieve data.
61.0	Manipulate data using PL/SQL. – The student will be able to:
61.01	Construct and execute SQL statements that manipulate data with DML statements.
61.02	Describe when to use implicit or explicit cursors.
61.03	Create code to use SQL implicit cursor attributes to evaluate cursor activity.
62.0	Use transaction control statements. – The student will be able to:
62.01	Define a transaction and give an example.
62.02	Construct and execute a transaction control statement.
63.0	Use IF conditional control statements. – The student will be able to:
63.01	Construct and use an IF statement.
63.02	Construct and use an IF -ELSIF statement.
63.03	Create SQL to handle null conditions in an IF statement.
64.0	Use CASE conditional control statements. – The student will be able to:
64.01	Construct and use CASE statements.

64.02	Construct and use CASE expressions.
64.03	Include syntax to handle null conditions in a CASE statement.
64.04	Include syntax to handle Boolean conditions in IF and CASE statements.
65.0	Use basic LOOP iterative control statements. – The student will be able to:
65.01	Describe the types of LOOP statements and their uses.
65.02	Create SQL containing a basic loop and an EXIT statement.
65.03	Create SQL containing a basic loop and an EXIT statement with conditional termination.
66.0	Use WHILE and FOR loop iterative control statements. – The student will be able to:
66.01	Construct and use the WHILE looping construct.
66.02	Construct and use the FOR looping construct.
66.03	Describe when a WHILE loop is used.
66.04	Describe when a FOR loop is used.
67.0	Use nested loop iterative control statements. – The student will be able to:
67.01	Construct and execute SQL using nested loops.
67.02	Evaluate a nested loop construct and identify the exit point.
68.0	Use explicit cursors. – The student will be able to:
68.01	List the guidelines for declaring and controlling explicit cursors.
68.02	Create SQL code to open a cursor and fetch a piece of data into a variable.
68.03	Use a simple loop to fetch multiple rows from a cursor.
68.04	Create SQL code to close a cursor.
69.0	Use explicit cursor attributes. – The student will be able to:
69.01	Define a record structure.
69.02	Create SQL code to process the row of an active set using record types in cursors.
69.03	Use cursor attributes to retrieve information about the state of an explicit cursor.
70.0	Use cursor FOR loops. – The student will be able to:
70.01	List and explain the benefits of using cursor FOR loops.



70.02	Create SQL code to declare a cursor and manipulate it in a FOR loop.
70.03	Create SQL code containing a cursor FOR loop using a subquery.
71.0	Use cursors with parameters. – The student will be able to:
71.01	List the benefits of using parameters with cursors.
71.02	Create SQL code to declare and manipulate a cursor with a parameter.
72.0	Use cursors for UPDATE transactions. – The student will be able to:
72.01	Create SQL code to lock rows before an update using the appropriate clause.
72.02	Explain the effect of using NOWAIT in an update cursor declaration.
72.03	Create SQL code to use the current row of the cursor in an UPDATE or DELETE statement.
73.0	Use multiple cursors. – The student will be able to:
73.01	Explain the need for using multiple cursors to produce multilevel reports.
73.02	Create SQL code to declare and manipulate multiple cursors within nested loops.
73.03	Create SQL code to declare and manipulate multiple cursors using parameters.
74.0	Handle exceptions. – The student will be able to:
74.01	Describe the advantages of including exception handling code.
74.02	Describe the purpose of an EXCEPTION section in a SQL block.
74.03	Create SQL code to include an EXCEPTION section.
74.04	List the guidelines for exception handling.
75.0	Trap database server exceptions. – The student will be able to:
75.01	Distinguish between errors defined by the database server and those defined by the programmer.
75.02	Differentiate between errors that are handled implicitly and explicitly by the database server.
75.03	Write SQL code to trap a predefined server error.
75.04	Write SQL code to trap a non-predefined database server error.
75.05	Write SQL code to identify an exception by error code and by error message.
76.0	Trap user-defined exceptions. – The student will be able to:
76.01	Write SQL code to name a user-defined exception.

76.02	Write SQL code to raise an exception.
76.03	Write SQL code to handle a raised exception.
76.04	Write SQL code to use RAISE_APPLICATION_ERROR.
77.0	Create procedures. – The student will be able to:
77.01	Differentiate between anonymous blocks and subprograms.
77.02	Identify the benefits of using subprograms.
77.03	Describe a stored procedure.
77.04	Create a procedure.
77.05	Describe how a stored procedure is invoked.
78.0	Use parameters in procedures. – The student will be able to:
78.01	Describe how parameters contribute to a procedure.
78.02	Define a parameter.
78.03	Create a procedure using a parameter.
78.04	Invoke a procedure that has parameters.
78.05	Distinguish between formal and actual parameters.
79.0	Pass parameters. – The student will be able to:
79.01	List the types of parameter modes.
79.02	Create a procedure that passes parameters.
79.03	Identify three methods for passing parameters.
79.04	Describe the DEFAULT option for parameters.
80.0	Create stored functions. – The student will be able to:
80.01	Describe the difference between a stored procedure and a stored function.
80.02	Create a SQL block containing a function.
80.03	Identify ways in which functions may be invoked.
80.04	Create a SQL block that invokes a function that has parameters.
81.0	Use functions in SQL statements. – The student will be able to:

81.01	Describe where user-defined functions can be called from within an SQL statement.
81.02	Describe the restrictions on calling functions from SQL statements.
81.03	Describe the purpose of the Data Dictionary.
81.04	Differentiate between the three types of Data Dictionary views.
81.05	Write SQL SELECT statements to retrieve information from the Data Dictionary.
81.06	Explain the use of DICTIONARY as a Data Dictionary search engine.
82.0	Manage procedures and functions. – The student will be able to:
82.01	Describe how exceptions are propagated.
82.02	Remove a function and a procedure.
82.03	Use Data Dictionary views to identify and manage stored procedures.
83.0	Manage object privileges. – The student will be able to:
83.01	List and explain several object privileges.
83.02	Explain the function of the EXECUTE object privilege.
83.03	Write SQL statements to grant and revoke object privileges.
84.0	Use invoker's rights. – The student will be able to:
84.01	Contrast invoker's rights with definer's rights.
84.02	Create a procedure that uses invoker's rights.
85.0	Create packages. – The student will be able to:
85.01	Describe a package, its components, and the reasons for use.
85.02	Create packages containing related variables, cursors, constants, exceptions, procedures, and functions.
85.03	Create a SQL block that invokes a package construct.
86.0	Manage package constructs. – The student will be able to:
86.01	Explain the difference between public and private package constructs.
86.02	Designate a package construct as either public or private.
86.03	Specify the syntax to drop a package.
86.04	Identify Data Dictionary views used to manage packages.

86.05	Identify the guidelines for using packages.
87.0	Use advanced package concepts. – The student will be able to:
87.01	Write packages that use the overloading feature.
87.02	Write packages that use forward declarations.
87.03	Explain the purpose of a package initialization block.
87.04	Identify restrictions on using packaged functions in SQL statements.
88.0	Manage persistent state of package variables. – The student will be able to:
88.01	Identify persistent states of package variables.
88.02	Control the persistent state of a package cursor.
89.0	Use vendor-supplied packages. – The student will be able to:
89.01	Describe common uses for the vendor-supplied package.
89.02	Use the syntax to specify messages for the vendor-supplied package.
89.03	Describe the purpose for the vendor-supplied package.
89.04	Identify the exceptions used in conjunction with the vendor-supplied package.
90.0	Understand dynamic SQL. – The student will be able to:
90.01	Identify the stages through which all SQL statements pass.
90.02	Describe the reasons for using dynamic SQL to create an SQL statement.
90.03	List four SQL statements supporting Native Dynamic SQL.
90.04	Describe the benefits of Execute Immediate over Dynamic SQL.
91.0	Understand triggers. – The student will be able to:
91.01	Describe database triggers and their uses.
91.02	Differentiate between a database trigger and an application trigger.
91.03	List the guidelines for using triggers.
91.04	Compare and contrast database triggers and stored procedures.
92.0	Create DML triggers. – The student will be able to:
92.01	Create a DML trigger and identify its components.

92.02	Create a statement level trigger.
92.03	Describe the trigger firing sequence options.
92.04	Create a DML trigger that uses conditional predicates.
92.05	Create a row level trigger.
92.06	Create a row level trigger that uses OLD and NEW qualifiers.
92.07	Create an INSTEAD OF trigger.
93.0	Create DDL and database event triggers. – The student will be able to:
93.01	Describe the events that cause DDL and database event triggers to fire.
93.02	Create a trigger for a DDL statement.
93.03	Create a trigger for a database event.
93.04	Describe the functionality of the CALL statement.
93.05	Describe the cause of a mutating table.
94.0	Manage triggers. – The student will be able to:
94.01	View trigger information in the Data Dictionary.
94.02	Disable and enable a database trigger.
94.03	Remove a trigger from the database.
95.0	Use large object data types. – The student will be able to:
95.01	Compare and contrast LONG and LOB data types.
95.02	Describe LOB data types and how they are used.
95.03	Differentiate between internal and external LOBs.
95.04	Create and maintain LOB data types.
95.05	Migrate data from LONG to LOB.
96.0	Manage binary types. – The student will be able to:
96.01	Define binary types and the binary types column data type.
96.02	Create directory objects and view them in the Data Dictionary.
96.03	Manage and manipulate binary types.

97.0	Manage indexes. – The student will be able to:
97.01	Create and manipulate user-defined SQL records.
97.02	Create an INDEX.
97.03	Describe the difference between records, tables, and tables of records.
98.0	Manage dependencies. – The student will be able to:
98.01	Describe the implications of procedural dependencies.
98.02	Contrast dependent objects and referenced objects.
98.03	View dependency information in the Data Dictionary.
98.04	Use a script to create the objects required to display dependencies.
98.05	Use views to display dependencies.
98.06	Describe when automatic recompilation occurs.
98.07	Describe how to minimize dependency failures.
99.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
99.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
99.02	Locate, organize and reference written information from various sources.
99.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
99.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
99.05	Apply active listening skills to obtain and clarify information.
99.06	Develop and interpret tables and charts to support written and oral communications.
99.07	Exhibit public relations skills that aid in achieving customer satisfaction.
99.08	Evaluate program designs and implementations written by others for readability and usability.
100.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
100.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
100.02	Employ critical thinking and interpersonal skills to resolve conflicts.
100.03	Identify and document workplace performance goals and monitor progress toward those goals.
100.04	Conduct technical research to gather information necessary for decision-making.

101.0	Use information technology tools. – The student will be able to:
101.01	Use personal information management (PIM) applications to increase workplace efficiency.
101.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
101.03	Employ computer operations applications to access, create, manage, integrate, and store information.
101.04	Employ collaborative/groupware applications to facilitate group work.
102.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. – The student will be able to:
102.01	Describe the nature and types of business organizations.
102.02	Explain the effect of key organizational systems on performance and quality.
102.03	List and describe quality control systems and/or practices common to the workplace.
102.04	Explain the impact of the global economy on business organizations.
103.0	Describe the importance of professional ethics and legal responsibilities. – The student will be able to:
103.01	Evaluate and justify decisions based on ethical reasoning.
103.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
103.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
103.04	Interpret and explain written organizational policies and procedures.
104.0	Understand network systems. – The student will be able to:
104.01	Identify and select the most appropriate file format based on trade-offs (e.g., open file formats, text, proprietary and binary formats, compression and encryption formats).
104.02	Describe the issues that impact network functionality (e.g., latency, bandwidth, firewalls and server capability).
104.03	Describe common network protocols, such as IP, TCP, SMTP, HTTP, and FTP, and how these are applied by client-server and peer-to-peer networks.

**Course Number: CTS0067**  
**Occupational Completion Point: A**  
**Specialized Database Applications – 150 Hours – SOC Code 15-1141**

105.0 Program a database application. – The student will be able to:

105.01 Utilize loop statements.

105.02 Given a scenario, use arithmetic, comparison, and pattern-matching operators.

105.03 Create user-defined functions.

105.04 Utilize common built-in functions.

105.05 Declare variables in modules and procedures.

105.06 Declare arrays, and initialize elements of arrays.

105.07 Declare and use object variables and collections, and use their associated properties and methods.

105.08 Declare symbolic constants, and make them available locally or publicly.

105.09 Respond to events.

106.0 Utilize the basic concepts of database design. – The student will be able to:

106.01 Apply basic concepts of normalization.

106.02 Utilize the cascade update and cascade delete options.

107.0 Utilize SQL and UNION queries. – The student will be able to:

107.01 Utilize SQL to write common queries.

107.02 Refer to objects by using SQL.

107.03 Utilize union queries.

108.0 Implement program statements using objects. – The student will be able to:

108.01 Determine when to use data access objects.

108.02 Differentiate between objects and collections.

108.03 Write statements that access and modify database objects.

108.04 Utilize data access objects.



108.05	Select appropriate methods and property settings for use with specified objects.
109.0	Utilize debugging tools and write error handlers. – The student will be able to:
109.01	Trap errors.
109.02	Utilize debugging tools to suspend program execution, and to examine, step through, and reset execution of code.
109.03	Debug code samples.
109.04	Utilize the Debugger to monitor variable values.
109.05	Write an error handler.
110.0	Demonstrate file I/O. – The student will be able to:
110.01	Read from files.
110.02	Write to files.
110.03	Utilize record locking.
111.0	Create forms and identify all the properties of a form. – The student will be able to:
111.01	Choose form-specific and report-specific properties to set.
111.02	Choose control properties to set.
111.03	Assign event-handling procedures to controls in a form.
111.04	Define and create form and report modules.
111.05	Identify the scope of a form or report module.
111.06	Open multiple instances of a form, and refer to them.
111.07	Assign values to form properties.
111.08	Use form methods.
112.0	Manipulate data using object models. – The student will be able to:
112.01	Connect to a data source.
112.02	Open a recordset.
112.03	Insert, update, delete and find data.

113.0	Develop custom controls. – The student will be able to:
113.01	Set properties for custom controls.
113.02	Customize user interface controls.
114.0	Utilize API functions. – The student will be able to:
114.01	Properly declare functions.
114.02	Use the by value and by reference parameters.
115.0	Demonstrate database replication and implement database replication using programming tools. – The student will be able to:
115.01	Make a database replicable.
115.02	View a synchronization schedule.
115.03	Explain the purpose of the Replication ID.
115.04	Explain how synchronization conflicts are resolved.
115.05	Identify the advantages of using replication of synchronization.
115.06	Identify the changes that the database engine makes when it converts a nonreplicable database into replicable database.
116.0	Analyze and implement security options. – The student will be able to:
116.01	Analyze a scenario, and recommend an appropriate type of security.
116.02	Explain the steps for implementing security.
116.03	Analyze code to ensure that it sets security options.
116.04	Write code to implement security options.
117.0	Implement client/server applications. – The student will be able to:
117.01	Demonstrate SQL pass through queries and application queries.
117.02	Access external data.
117.03	Trap errors that are generated by the server.
117.04	Optimize connections.
117.05	Optimize performance for a given client/server application.

118.0	Optimize the performance of a database. – The student will be able to:
118.01	Differentiate between single-field and multiple-field indexes.
118.02	Optimize queries.
118.03	Restructure queries to allow faster execution.
118.04	Optimize performance in distributed applications.
118.05	Optimize performance for client/server applications.
119.0	Perform application distribution. – The student will be able to:
119.01	Prepare an application for distribution.
119.02	Analyze various methods to distribute a client/server application.
119.03	Distribute custom controls with an application.
119.04	Provide online help.
120.0	Test and debug databases. – The student will be able to:
120.01	Implement error handling.
120.02	Test and debug library databases.
121.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. – The student will be able to:
121.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
121.02	Explain emergency procedures to follow in response to workplace accidents.
121.03	Create a disaster and/or emergency response plan.
122.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. – The student will be able to:
122.01	Employ leadership skills to accomplish organizational goals and objectives.
122.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
122.03	Conduct and participate in meetings to accomplish work tasks.
122.04	Employ mentoring skills to inspire and teach others.
123.0	Explain the importance of employability skill and entrepreneurship skills. – The student will be able to:

123.01 Identify and demonstrate positive work behaviors needed to be employable.
123.02 Develop personal career plan that includes goals, objectives, and strategies.
123.03 Examine licensing, certification, and industry credentialing requirements.
123.04 Maintain a career portfolio to document knowledge, skills, and experience.
123.05 Evaluate and compare employment opportunities that match career goals.
123.06 Identify and exhibit traits for retaining employment.
123.07 Identify opportunities and research requirements for career advancement.
123.08 Research the benefits of ongoing professional development.
123.09 Examine and describe entrepreneurship opportunities as a career planning option.
124.0 Responsible use of technology and information. – The student will be able to:
124.01 Compare and contrast appropriate and inappropriate social networking behaviors.
124.02 Describe and demonstrate ethical and responsible use of modern communication media and devices.
124.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 11, Language 11, and Reading 11. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Applied Information Technology  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y300400
CIP Number	0511010302
Grade Level	30, 31
Standard Length	600 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to computer application skills including computer hardware, software applications, web applications, computer programming, webpage design and advanced web tools, systems support and maintenance, network concepts, relational database concepts, multimedia tools, cybersecurity ; extensive exploration of information technology careers; strategies for success including goal setting, study skills, organizing skills, learning styles, employability skills, and service learning; and core academic skills with a strong emphasis on effective communication skills.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

## Program Structure

This program is a planned sequence of instruction consisting of eight occupational completion points. To complete this program, students must complete OCP A and OCP B, plus one or more of the subsequent OCPs (C-H).

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0072	IT & Web Systems	BUS ED 1 @2 COMPU SCI 6 INFO TECH 7G	300 hours	15-1151
C	CTS0063	Database Essentials		150 hours	15-1151
D	CTS0030	Programming Fundamentals		150 hours	15-1151
E	CTS0073	Web Development Fundamentals		150 hours	15-1151
F	CTS0075	Multimedia Systems		150 hours	15-1151
G	CTS0025	Computer Networking		150 hours	15-1151
H	CTS0068	Cybersecurity Essentials		150 hours	15-1151



## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Demonstrate proficiency on the principles of design.
- 16.0 Demonstrate proficiency planning an effective website.
- 17.0 Demonstrate proficiency using web development tools and techniques.
- 18.0 Demonstrate proficiency using specialized web design software.
- 19.0 Demonstrate proficiency gathering and preparing web content.
- 20.0 Demonstrate an awareness of preparing a website for launch.
- 21.0 Explain motherboard components, types and features.
- 22.0 Explain the purpose and characteristics of CPUs and their features.
- 23.0 Perform installation and configuration activities.
- 24.0 Perform the process for problem diagnostics and problem resolution through wireless, infrared, telephone, e-mail, remote access, or direct contact.
- 25.0 Demonstrate knowledge of presentation production issues.
- 26.0 Demonstrate proficiency using computer networks.
- 27.0 Demonstrate proficiency communicating over the Internet.
- 28.0 Demonstrate proficiency in troubleshooting, repair and maintenance of hardware.
- 29.0 Demonstrate proficiency in the basic principles of security concepts and technologies.
- 30.0 Demonstrate proficiency in operational procedures as they relate to computer equipment and components.
- 31.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.

- 32.0 Solve problems using critical thinking skills, creativity and innovation.
- 33.0 Use information technology tools.
- 34.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- 35.0 Describe the importance of professional ethics and legal responsibilities.
- 36.0 Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs.
- 37.0 Develop the process of creating an entity by identifying relationships.
- 38.0 Formulate and assemble initial entity relationship by expanding on modeling concepts.
- 39.0 Consider the degree and optionality of relationships of entities.
- 40.0 Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams.
- 41.0 Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships.
- 42.0 Apply the complex ERM information by fine-tuning entities and the process for relating them.
- 43.0 Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved.
- 44.0 Manipulating data.
- 45.0 Building and modifying tables.
- 46.0 Performing queries and filtering records.
- 47.0 Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance.
- 48.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 49.0 Explain the importance of employability skill and entrepreneurship skills.
- 50.0 Demonstrate personal money-management concepts, procedures, and strategies.
- 51.0 Plan program design.
- 52.0 Code programs.
- 53.0 Test programs.
- 54.0 Perform program maintenance.
- 55.0 Create and maintain documentation.
- 56.0 Develop an awareness of software quality assurance.
- 57.0 Develop an understanding of programming techniques and concepts.
- 58.0 Design structured programs.
- 59.0 Demonstrate proficiency in page design applicable to the WWW.
- 60.0 Demonstrate proficiency in webpage design applicable to the WWW.
- 61.0 Demonstrate proficiency in using a WYSIWG editor, web design, or web animation software for webpage design.
- 62.0 Demonstrate proficiency in using digital photography and digital imaging.
- 63.0 Design and create webpages suitable for publishing to the Internet.
- 64.0 Describe how website performance is monitored and analyzed.
- 65.0 Demonstrate proficiency in hosting a website.
- 66.0 Demonstrate the ability to attract and track traffic for a website.
- 67.0 Demonstrate knowledge of presentation production issues.
- 68.0 Demonstrate proficiency in using digital photography and digital imaging.
- 69.0 Demonstrate basic video production.
- 70.0 Demonstrate set-up and configuration of a computer for video applications.
- 71.0 Demonstrate the basic operation of a video workstation.

- 72.0 Demonstrate basic audio production.
- 73.0 Set-up and configure a computer for audio applications.
- 74.0 Operate an audio workstation.
- 75.0 Demonstrate proficiency in using presentation software and equipment.
- 76.0 Demonstrate understanding of network technologies.
- 77.0 Understand, install and configure network hardware.
- 78.0 Understand, install and configure networking devices.
- 79.0 Understand, install and configure network management software.
- 80.0 Understand, install and configure networking tools.
- 81.0 Install, configure, and manage network security hardware and software devices.
- 82.0 Demonstrate an understanding of cybersecurity, the terminology used, its history and culture, and trends.
- 83.0 Recognize the following types of malicious code and specify the appropriate actions to take to mitigate vulnerability and risk.
- 84.0 Recognize and be able to differentiate and explain the following access control models.
- 85.0 Compare and contrast methods of authentication.
- 86.0 Recognize the following attacks and specify the appropriate actions to take to mitigate vulnerability and risk.
- 87.0 The processes and risks associated with the following security concerns and tasks.
- 88.0 The administration of the following types of remote access technologies.
- 89.0 The administration of the following email security concepts.
- 90.0 The administration of the following Internet security concepts.
- 91.0 The administration of the following vulnerabilities.
- 92.0 The administration of the following directory security concepts.
- 93.0 The administration of the following file transfer protocols and concepts.
- 94.0 The administration of the following wireless technologies and concepts.
- 95.0 Compare and contrast the following types of intrusion detection in terms of implementation and configuration.
- 96.0 Be able to identify the following different kinds of cryptographic algorithms.
- 97.0 Understand how cryptography and digital signatures address the following security concepts.
- 98.0 Understand the following concepts of PKI (Public Key Infrastructure).
- 90.0 Understand the following concepts of Key Management and Certificate Lifecycles.

Florida Department of Education  
Student Performance Standards

Program Title: Applied Information Technology  
Career Certificate Program Number: Y300400

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

**Course Number: CTS0072**  
**Occupational Completion Point: B**  
**IT & Web Systems – 300 Hours – SOC Code 15-1151**

15.0 Demonstrate proficiency on the principles of design. – The student will be able to

15.01 Identify industry best practices in visual design (e.g., color schemes, fonts, navigation methods, pagination).

15.02 Explain the key concepts of meeting client needs.

15.03 Apply the principles of Human Computer Interface (HCI) to design and develop an effective look and feel for a website.

15.04 Design and create a webpage for optimal display in multiple browsers.

16.0 Demonstrate proficiency planning an effective website. – The student will be able to:

16.01 Compare and contrast site maps and wireframes.

16.02 Develop an effective site map for a website.

16.03 Create page layout wireframes for a website.

16.04 Classify web development tasks according to when they are performed during the web development cycle.

16.05 Describe the different types of business requirements that apply to website design.

16.06 Design business requirements to help ensure success for a specific website.

16.07 Demonstrate ability to use effective designer-client communication skills.

17.0 Demonstrate proficiency using web development tools and techniques. – The student will be able to:

17.01 Compare and contrast writing HTML using a text editor versus using a WYSIWYG editor.

17.02 Design and create an effective webpage template.

17.03 Create attractive, engaging, and efficient webpages using a WYSIWYG editor.

17.04 Create an appropriate directory structure, naming convention protocol, and file organization for a website.

17.05 Create DHTML and XML documents using editors or converters.

18.0 Demonstrate proficiency using specialized web design software. – The student will be able to:

18.01 Compare and contrast various specialized web design software (e.g., Photoshop, Dreamweaver).

18.02 Demonstrate proficiency using various specialized web design software (e.g., Photoshop, Dreamweaver).

19.0 Demonstrate proficiency gathering and preparing and evaluating web content. – The student will be able to:

19.01	Characterize effective writing styles and conventions for the web.
19.02	Create effective written content for the web.
19.03	Prepare various types of graphical content for use on a webpage.
19.04	Access and digitize graphics through various resources (e.g., scanner, digital cameras, on-line graphics, clipart, CD-ROMs).
19.05	Create and edit images using image or graphic design software.
19.06	Compare and contrast static versus dynamic web content.
19.07	Evaluate sources for accuracy of content.
20.0	Demonstrate an awareness of preparing a website for launch. – The student will be able to:
20.01	Evaluate a website for basic usability and accessibility issues.
20.02	List the steps that are necessary to determine when a website is ready to launch.
20.03	Develop a User Testing Plan.
20.04	Demonstrate the ability to organize and execute a user testing of a website in multiple browsers.
21.0	Explain motherboard components, types and features. – The student will be able to:
21.01	Identify different motherboard form factors (ATX/BTX and micro ATX).
21.02	Identify input/output interfaces (e.g. USB, serial, NIC).
21.03	Identify the different types of bus slots (e.g. PCI, AGP, PCMCIA).
21.04	Identify the BIOS/CMOS/Firmware (e.g. POST, CMOS battery).
22.0	Explain the purpose and characteristics of CPUs and their features. – The student will be able to:
22.01	Identify types of CPUs (e.g. AMD, Intel).
22.02	Define hyper threading.
22.03	Explain multi core (e.g. dual, triple, quad).
22.04	Explain the difference between onboard cache (e.g. L1, L2, L3).
22.05	Compare and contrast between real and actual speed.
22.06	Compare and contrast between 32 bit and 64 bit processing.
23.0	Perform installation and configuration activities. – The student will be able to:
23.01	Install and configure software including device drivers.

23.02	Install and configure operating system software.
23.03	Install and configure application software.
23.04	Install and configure peripherals including device drivers (e.g., scanners, cameras, printers).
23.05	Supervise the testing of operating system management systems (e.g., registry, INI files).
23.06	Prepare the hard disk and related issues for operating system installation (e.g., BIOS, disk controllers).
23.07	Format and partition the hard disk.
23.08	Verify the proper operation of the system (e.g., physical inspection, tests, utilities).
23.09	Compare and contrast memory technologies (e.g., RAM, ROM, virtual memory, memory management).
23.10	Demonstrate proficiency using various memory technologies (e.g., RAM, ROM, virtual memory, memory management).
23.11	Demonstrate proper use of user interfaces, command utilities and troubleshooting utilities.
23.12	Explain the basics of boot sequences, methods and startup utilities.
24.0	Perform the process for problem diagnostics and problem resolution through wireless, infrared, telephone, e-mail, remote access, or direct contact. – The student will be able to:
24.01	Identify, troubleshoot and propose solutions for configuration problems.
24.02	Identify, troubleshoot and propose solutions for software problems.
24.03	Identify, troubleshoot and propose solutions for hardware malfunctions.
24.04	Identify, troubleshoot and propose solutions for network malfunctions.
24.05	Plan and implement a system upgrade and downgrade.
24.06	Evaluate data recovery using various techniques (e.g., MBR repair tools, rescue disks, disk image, backup).
24.07	Organize and perform system maintenance activities (e.g., management console, SNMP, system monitors, diagnostics, virus management).
24.08	Demonstrate corporate interaction proficiency (e.g., responsibility, interaction, communication).
25.0	Demonstrate knowledge of presentation production issues. – The student will be able to:
25.01	Demonstrate knowledge of copyright laws including copyright statute, disclaimers, and filing procedure.
25.02	Demonstrate an understanding of graphic and other file formats (e.g., EPS, TIFF, JPEG, PNG, ASCII, MPEG, MIDI, AVI, WAV,) and knowledge of image size when scanning and saving files for use in different presentation types (web, computer, print).
25.03	Identify display device connectors and types.
25.04	Define refresh rate, resolution, multi-monitor and Degauss.



25.05	Demonstrate knowledge of presentation vocabulary/terms.
25.06	Compare and contrast and utilize various audio/video output solutions and devices.
25.07	Compare and contrast removable storage.
26.0	Demonstrate proficiency using computer networks. – The student will be able to:
26.01	Define networking and describe the purpose of a network.
26.02	Describe the conceptual background of digital networks including terminology and basics.
26.03	Describe various types of networks and the advantages and disadvantages of each.
26.04	Describe the use, advantages, and disadvantages of various network media.
26.05	Describe the function of various network devices.
26.06	Describe the difference between the internet and intranet.
26.07	Compare and contrast IP Version 6 and IP Version 4.
26.08	Compare and contrast the different network types.
26.09	Compare and contrast various implementation models.
27.0	Demonstrate proficiency communicating over the Internet. – The student will be able to:
27.01	Display understanding of how Internet Service Providers (ISP) operate and what role they play in enabling users to connect to the Internet.
27.02	Explain how the Internet works and how documents are connected and transferred.
27.03	Configure an email client for SMTP and POP3 servers, including port assignment.
27.04	Explain how the primary modes of Internet communication are used.
28.0	Demonstrate proficiency in troubleshooting, repair and maintenance of hardware. – The student will be able to:
28.01	Determine the troubleshooting methods and tools for peripheral devices.
28.02	Explain and interpret common device issues and basic troubleshooting methods.
28.03	Integrate common preventative maintenance techniques.

29.0	Demonstrate proficiency in the basic principles of security concepts and technologies. – The student will be able to:
29.01	Evaluate encryption technologies, software firewall, authentication technologies, and data security.
29.02	Summarize the following security features (e.g. encryption, malicious software protection BIOS security, password management, biometrics).
30.0	Demonstrate proficiency in operational procedures as they relate to computer equipment and components. – The student will be able to:
30.01	Compare and contrast ESD, EMI, RFI, and electrical safety.
30.02	Demonstrate proficiency in the use of state regulations for hazardous materials.
31.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
31.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
31.02	Locate, organize and reference written information from various sources.
31.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
31.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
31.05	Apply active listening skills to obtain and clarify information.
31.06	Develop and interpret tables and charts to support written and oral communications.
31.07	Exhibit public relations skills that aid in achieving customer satisfaction.
32.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
32.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
32.02	Employ critical thinking and interpersonal skills to resolve conflicts.
32.03	Identify and document workplace performance goals and monitor progress toward those goals.
32.04	Conduct technical research to gather information necessary for decision-making.
33.0	Use information technology tools. – The student will be able to:
33.01	Use personal information management (PIM) applications to increase workplace efficiency.
33.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email and internet applications.

33.03	Employ computer operations applications to access, create, manage, integrate and store information.
33.04	Employ collaborative/groupware applications to facilitate group work.
34.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. – The student will be able to:
34.01	Describe the nature and types of business organizations.
34.02	Explain the effect of key organizational systems on performance and quality.
34.03	List and describe quality control systems and/or practices common to the workplace.
34.04	Explain the impact of the global economy on business organizations.
35.0	Describe the importance of professional ethics and legal responsibilities. – The student will be able to:
35.01	Evaluate and justify decisions based on ethical reasoning.
35.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
35.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace or on social media.
35.04	Interpret and explain written organizational policies and procedures.

**Course Number: CTS0063**  
**Occupational Completion Point: C**  
**Database Essentials – 150 Hours – SOC Code 15-1151**

36.0	Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs. – The student will be able to:
36.01	Identify and analyze the phases of the database development process.
36.02	Explain what conceptual data modeling and database design involves.
36.03	Compare database development process with that of the application development process.
36.04	Identify the need for databases and why they are used.
36.05	Explain the various types of databases (i.e., flat file, relational) and the appropriate use of each.
36.06	Demonstrate proficiency in design methodology by completing appropriate tasks during the appropriate time of the developmental life cycle.
36.07	Demonstrate proficiency in design methodology by considering where the database will reside.
37.0	Develop the process of creating an entity by identifying relationships. – The student will be able to:
37.01	Identify and model various types of entities.
37.02	Identify naming and drawing conventions for entities.
37.03	Sequence the steps that are necessary for creation of an entity.
37.04	Analyze and model the relationships between entities.
38.0	Formulate and assemble initial entity relationship by expanding on modeling concepts. – The student will be able to:
38.01	Analyze and model attributes.
38.02	Identify unique identifiers for each entity.
38.03	Develop an entity relationship diagram tagging attributes with optionality.
39.0	Consider the degree and optionality of relationships of entities. – The student will be able to:
39.01	Create models and entity relationship information requirements and interviews.
39.02	Begin to differentiate between one-to-many, many-to-many and one-to-one relationships.
39.03	Identify relationship between two entities by reading a given diagram.
39.04	Create a relationship between instances of the same entity.

39.05	Read an entity relationship model in order to validate it.
40.0	Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams. – The student will be able to:
40.01	Identify the significance of an attribute that has more than one value for each entity instance.
40.02	Evaluate appropriate methods of storing validation rules for attributes.
40.03	Recognize unique identifiers inherited from other entities.
40.04	Sequence the steps involved in resolving a many-to-many relationship.
41.0	Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships. – The student will be able to:
41.01	Validate that an attribute is properly placed based upon its dependence on its entity's unique identifier (UID).
41.02	Model advanced data constructs including recursive relationships, subtypes, and exclusive relationships.
41.03	Enforce referential integrity.
42.0	Apply the complex ERM information by fine-tuning entities and the process for relating them. – The student will be able to:
42.01	Describe a relational database and how it is different from other database systems.
42.02	Define primary keys and foreign keys and describe their purpose.
42.03	Describe what data integrity refers to and list some constraints.
42.04	Explain how database design fits into the database development process.
42.05	Translate an entity-relationship model into a relational database design.
43.0	Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved. – The student will be able to:
43.01	Recognize raw data and evaluate the steps for creating a data group in unnormalized form (UNF).
44.0	Manipulating data. – The student will be able to:
44.01	Determine appropriate data inputs and outputs for an existing database.
44.02	Demonstrate proficiency in record management (i.e., entering, editing, finding, selecting, sorting, deleting records).
44.03	Change the layout of a datasheet.
44.04	Create forms, reports, mailing labels, and charts using a database.

44.05	Export data to appropriate software applications.
44.06	Demonstrate proficiency in coordinating databases with appropriate software applications.
45.0	Building and modifying tables. – The student will be able to:
45.01	Create a database table.
45.02	Create table structures and establish table relationships.
45.03	Determine fields and assign data types in a database table.
45.04	Demonstrate appropriate manipulation of database tables (i.e., enter data, add, delete records).
45.05	Modify a database table by adding, deleting and removing fields.
45.06	Demonstrate proficiency in the appropriate use of database wizards.
46.0	Performing queries and filtering records. – The student will be able to:
46.01	Design a query and extract specific data from a database table.
46.02	Create a calculated field.
46.03	Filter data in records by selection and by form.
46.04	Modify a saved query.
46.05	Explain what a Database Warehouse and its uses.
47.0	Demonstrate the importance of health, safety, and environmental management systems in organizations and their importance to organizational performance and regulatory compliance. – The student will be able to:
47.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.
47.02	Explain emergency procedures to follow in response to workplace accidents.
47.03	Create a disaster and/or emergency response plan.
48.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. – The student will be able to:
48.01	Employ leadership skills to accomplish organizational goals and objectives.
48.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
48.03	Conduct and participate in meetings to accomplish work tasks.
48.04	Employ mentoring skills to inspire and teach others.

49.0	Explain the importance of employability skill and entrepreneurship skills. – The student will be able to:
49.01	Identify and demonstrate positive work behaviors needed to be employable.
49.02	Develop personal career plan that includes goals, objectives and strategies.
49.03	Examine licensing, certification and industry credentialing requirements.
49.04	Maintain a career portfolio to document knowledge, skills and experience.
49.05	Evaluate and compare employment opportunities that match career goals.
49.06	Identify and exhibit traits for retaining employment.
49.07	Identify opportunities and research requirements for career advancement.
49.08	Research the benefits of ongoing professional development.
49.09	Examine and describe entrepreneurship opportunities as a career planning option.
50.0	Demonstrate personal money-management concepts, procedures, and strategies. – The student will be able to:
50.01	Identify and describe the services and legal responsibilities of financial institutions.
50.02	Describe the effect of money management on personal and career goals.
50.03	Develop a personal budget and financial goals.
50.04	Complete financial instruments for making deposits and withdrawals.
50.05	Maintain financial records.
50.06	Read and reconcile financial statements.
50.07	Research, compare and contrast investment opportunities.

**Course Number: CTSS0030**  
**Occupational Completion Point: D**  
**Programming Fundamentals – 150 Hours – SOC Code 15-1151**

51.0 Plan program design. – The student will be able to:

51.01 Formulate a plan to determine program specifications individually or in groups.

51.02 Use a graphical representation or pseudocode to represent the structure in a program or subroutine.

51.03 Design programs to meet business needs and requirements using problem-solving strategies.

51.04 Prepare proper input/output layout specifications.

51.05 Manually trace the execution of programs and verify that programs follow the logic of their design as documented.

51.06 Analyze the business needs and requirements.

51.07 Determine what kind of information the desired program must process.

51.08 Formulate concise descriptions of a program's task and purpose.

51.09 Formulate concise descriptions of task and purpose of a program's pieces.

51.10 Organize programs according to the problem analysis.

51.11 Recognize changes in the problem statement.

51.12 Suggest changes in the program organization.

52.0 Code programs. – The student will be able to:

52.01 Write programs according to recognized programming standards.

52.02 Write internal documentation statements as needed in the program source code.

52.03 Code programs using logical statements (e.g., If-Then-Else, Do...While).

52.04 Enter and modify source code using a program language editor.

52.05 Code routines within programs that validate input data.

52.06 Code programs using object-oriented languages (techniques).

52.07 Select the essential aspects of a problem statement.

52.08 Provide a solution to a problem.



52.09	Find solutions to an extended problem statement.
52.10	Utilize reference manuals and help systems.
52.11	Use pre-defined functions within programs.
53.0	Test programs. – The student will be able to:
53.01	Develop a plan for testing programs.
53.02	Develop data for use in program testing.
53.03	Perform debugging activities.
53.04	Distinguish among the different types of program and design errors.
53.05	Evaluate program test results.
53.06	Execute programs and subroutines as they relate to the total application.
53.07	Develop examples that illustrate the core behavior of each program.
53.08	Develop examples that illustrate the core behavior of each program component.
53.09	Illustrate the behavior of boundary cases.
53.10	Demonstrate an understanding that engineering artifacts requires rigorous and systematic testing.
53.11	Use examples to show that the solution meets pre-determined criteria.
53.12	Demonstrate understanding that testing can expose problems but not prove the correctness of the design in an absolute sense.
53.13	Compile (interpret) and run programs.
54.0	Perform program maintenance. – The student will be able to:
54.01	Analyze output to identify and annotate errors or enhancements.
55.0	Create and maintain documentation. – The student will be able to:
55.01	Follow established documentation standards.
56.0	Develop an awareness of software quality assurance. – The student will be able to:
56.01	Identify the legal and social consequences of errors in software.

56.02	Describe copyright and other laws that relate to software theft and misuse.
56.03	Describe software security measures to protect computer systems and data from unauthorized use and tampering (e.g., physical security, passwords, encryption, virus protection/prevention).
56.04	Develop an awareness of version control systems and Open Source Software.
57.0	Develop an understanding of programming techniques and concepts. – The student will be able to:
57.01	Identify the basic constructs used in structured programming.
58.0	Design structured programs. – The student will be able to:
58.01	Design programs that model mathematical relationships from application areas (e.g., accounting, economics, multimedia, programming, science, web).
58.02	Design programs that deal with multi-faceted objects (e.g., personnel records, physical objects, attributes of HTML tags).
58.03	Design programs that deal with mixed classes of objects (e.g., a class of geometric shapes containing circles, rectangles, triangles, squares, polygons).
58.04	Design programs that deal with objects of undetermined size (e.g., shopping lists, family trees, file directories on computers, websites).

**Course Number: CTS0073**  
**Occupational Completion Point: E**  
**Web Development Fundamentals – 150 Hours – SOC Code 15-1151**

59.0	Demonstrate proficiency in page design applicable to the WWW. – The student will be able to:
59.01	Identify and convert graphic formats.
59.02	Demonstrate proficiency in adding Java scripts to webpages.
60.0	Demonstrate proficiency in webpage design applicable to the WWW. – The student will be able to:
60.01	Determine the objectives and the audience for webpages.
60.02	Identify design strategies to reach and keep an audience.
60.03	Use storyboarding to plan a website.
60.04	Create styles and other design elements (e.g. backgrounds, colors, fonts, buttons).
61.0	Demonstrate proficiency in using a WYSIWG editor, web design, or web animation software for webpage design. – The student will be able to:
61.01	Apply style sheets for consistent website design.
61.02	Create and edit images and photographs for webpages using digital imaging software (e.g., ImageReady in Photoshop).
61.03	Insert audio files into a webpage.
61.04	Create, edit and integrate video files into a webpage.
61.05	Create, edit and integrate animation files into a webpage.
61.06	Demonstrate an understanding of photograph compression factors such as transmission speed, color reduction, and browser support.
61.07	Demonstrate knowledge of image formats related to photos and graphics on the Internet (e.g. Graphic formats (TIFF & EPS), Web formats (JPEG, GIF, PNG).
61.08	Save and export a photograph to the web in the format best for image quality and file size.
61.09	Build, optimize, edit, and test web pages for publication.
61.10	Create a webpage that utilizes plug-ins.
61.11	Demonstrate an understanding of network and web implementation issues (e.g., bandwidth, compression, streaming).
61.12	Compare and contrast various methods by which information may be accessed on the Internet/Intranet (e.g., FTP, telnet, browser).
61.13	Demonstrate an understanding of file encryption methods (e.g., secure server, unsecured server).

62.0	Demonstrate proficiency in using digital photography and digital imaging. – The student will be able to:
62.01	Demonstrate knowledge of ethics related to digital imaging, legal and consent issues.
62.02	Apply effective design principles in digital photography compositions.
62.03	Illustrate the essence of an event, quote, or slogan through digital photography/imaging.
62.04	Demonstrate skill in using digital imaging software for image manipulation, color correction and special effects to creatively convey a message or literary interpretation.
62.05	Demonstrate skill in scanning and cropping photographs.
63.0	Design and create webpages suitable for publishing to the Internet. – The student will be able to:
63.01	Explain the need for web-based applications.
63.02	Evaluate a website for basic usability and accessibility issues.
63.03	Display an understanding of the purposes of site maps and wireframes.
63.04	Develop an effective site map for a website.
63.05	Develop effective wireframes for a website.
63.06	Identify industry best practices in visual design.
63.07	Explain the key concepts of meeting client needs.
63.08	Develop an effective look and feel for a website.
63.09	Develop an effective webpage template.
63.10	Describe a correct directory structure, naming convention protocol and file organization for a website.
63.11	Characterize effective writing for the web.
63.12	Create effective written content for the web.
63.13	Decide how to best prepare various types of graphical content for use on a web page.
63.14	Develop a User Testing Plan.
63.15	List the steps that are necessary to determine when a website is ready to launch.
63.16	Demonstrate the ability to organize and execute a user testing of a website.
64.0	Describe how website performance is monitored and analyzed. – The student will be able to:

64.01	Identify issues related to website maintenance.
64.02	Use webpage validation tools.
64.03	Describe website performance metrics (e.g., visits, time-on-page, time-on-site) and discuss their design implications.
64.04	Demonstrate knowledge of accessibility problems and solutions.
64.05	Examine indexing, page ranking, basic Search Engine Optimization techniques.
64.06	Explore common website analytic tools.
64.07	Construct webpages with streaming media content.
65.0	Demonstrate proficiency in hosting a website. – The student will be able to:
65.01	Apply professional guidelines to choose, search for and register a domain name.
65.02	Evaluate criteria upon which to select an appropriate web host.
65.03	Make generalizations about optimal download speed for a particular website.
65.04	Demonstrate the ability to upload and download files using FTP protocol.
65.05	Develop a Maintenance Plan for a client.
66.0	Demonstrate the ability to attract and track traffic for a website. – The student will be able to:
66.01	Explain and describe the best practices for attracting traffic to websites.
66.02	Evaluate an effective search engine optimization strategy.
66.03	Describe tactics for building online credibility.
66.04	Explain how to use standard techniques to gather and/or track site statistics.

**Course Number: CTS0075**  
**Occupational Completion Point: F**  
**Multimedia Systems – 150 Hours – SOC Code 15-1151**

67.0 Demonstrate knowledge of presentation production issues. – The student will be able to:

67.01 Identify characteristics of various types of presentations (e.g., informing, selling, teaching, entertaining).

67.02 Identify presentation materials (e.g., handouts, seminar notebooks, business cards, coupons) and presentation marketing mediums (i.e., print media such as newspaper, magazines; TV; movies; computer presentations; interactive CD ROM; kiosks, webpages).

67.03 Identify design characteristics (e.g., fonts, size and styles, backgrounds) that are suited for each type of presentation format and material.

67.04 Demonstrate knowledge of copyright laws including copyright statute, disclaimers, and filing procedures.

67.05 Research and identify skills needed for career positions in multimedia.

67.06 Demonstrate an understanding of graphic and other file formats (e.g., EPS, TIFF, JPEG, ASCII, MPEG, MIDI, AVI, WAV) and knowledge of image size when scanning and saving files for use in different presentation types (e.g., web, computer, print).

67.07 Demonstrate knowledge of presentation vocabulary/terms.

68.0 Demonstrate proficiency in using digital photography and digital imaging. – The student will be able to:

68.01 Demonstrate knowledge of ethics related to digital imaging, legal and consent issues.

68.02 Apply effective design principles in digital photography compositions.

68.03 Illustrate the essence of an event, quote, or slogan through digital photography/imaging.

68.04 Demonstrate skill in using digital imaging software for image manipulation, color correction, and special effects to creatively convey a message or literary interpretation.

68.05 Demonstrate skill in scanning and cropping photographs.

68.06 Incorporate scanned or digitally taken photographs into documents (poster, brochure, card, photo journalism story, report or book covers, letterhead) that have been designed using desktop publishing software or the desktop publishing features of word processing software.

69.0 Demonstrate basic video production. – The student will be able to:

69.01 Use student device or current industry standard production video equipment.

69.02 Operate camera in studio and location (field) production environments.

69.03 Demonstrate understanding of digital video storage concepts and digital storage media.

69.04 Demonstrate knowledge of and the ability to operate digital recording decks, and other digital storage devices.

69.05 Identify and select microphones for production needs.

69.06	Determine appropriate lighting needs for production settings.
69.07	Identify location and studio lighting types, method of use and application.
70.0	Demonstrate set-up and configuration of a computer for video applications. – The student will be able to:
70.01	Install basic peripheral devices related to video programs.
70.02	Install and configure software related to video programs.
70.03	Demonstrate basic knowledge of computer system requirements.
70.04	Demonstrate basic knowledge of installing plug-ins or additional audio source material such as beats and or samples.
70.05	Understand the signal flow of a digital video workstation.
71.0	Demonstrate the basic operation of a video workstation. – The student will be able to:
71.01	Demonstrate knowledge of the digital video workstation interface.
71.02	Demonstrate a working familiarity and understanding of the function and operation of digital video workstations.
71.03	Describe a full digital media production cycle.
71.04	Demonstrate ability to edit, cut, erase, and insert video utilizing various digital production techniques.
71.05	Record video directly to the digital video workstation.
71.06	Demonstrate knowledge of editing video according to message.
71.07	Demonstrate skill in using video effects and plug-ins.
71.08	Describe a first complete run-through of the video production process.
71.09	Characterize the qualities of effective communication in a completed video.
71.10	Prepare a video project for final compositing and export.
71.11	Transfer video files between various video software applications.
71.12	Export finished video.
71.13	Identify and describe solutions to the challenges and obstacles that arise in a video production.
72.0	Demonstrate basic audio production. – The student will be able to:
72.01	Describe digital audio storage concepts and digital storage media.

72.02	Operate digital recording decks and other digital storage devices.
72.03	Describe the function and operation of digital audio workstations.
72.04	Edit, cut, erase and insert sound utilizing various digital production techniques.
72.05	Perform digital noise reduction and noise extraction via spectral display.
73.0	Set-up and configure a computer for audio applications. – The student will be able to:
73.01	Install basic peripheral devices related to audio programs.
73.02	Install and configure software related to audio programs.
73.03	Demonstrate basic knowledge of computer system requirements.
73.04	Install plug-ins or additional audio source material such as beats and or samples.
73.05	Diagram the signal flow of a digital audio workstation.
74.0	Operate an audio workstation. – The student will be able to:
74.01	Demonstrate knowledge of the digital audio workstation interface.
74.02	Create and arrange a multi-track project.
74.03	Create interest and effect using editing techniques
74.04	Design and edit audio using a waveform editor.
74.05	Record audio directly to the digital audio workstation.
74.06	Mix audio.
74.07	Demonstrate skill in using audio effects and plug-ins.
74.08	Prepare an audio project for finishing and final mix down.
74.09	Transfer audio files between various audio software applications.
74.10	Demonstrate the understanding of audio file bit depth, bandwidth and dithering and be able to explain when and where these apply in various applications of digital audio production.
74.11	Export finished audio.
75.0	Demonstrate proficiency in using presentation software and equipment. – The student will be able to:
75.01	Using presentation software, create a multimedia presentation that incorporates shot and edited video, animation, music, narration and adheres to good design principles, use of transitions, and effective message conveyance.



75.02 Demonstrate knowledge of the roles and responsibilities of a multimedia production team (e.g. project manager, creative or design director, content experts, writers, graphic designers, animators, sound designers, videographer, interface designers/programmers).

75.03 Collaborate with team members to plan, edit, evaluate, and present a multimedia presentation.

**Course Number: CTS0025**  
**Occupational Completion Point: G**  
**Computer Networking – 150 Hours – SOC Code 15-1151**

76.0	Demonstrate understanding of network technologies–The student will be able to:
76.01	Explain the function of common networking protocols such as TCP,FTP, UDP, TCP/IP suite, DHCP, TFTP, DNS, HTTP(S), ARP, SIP (VoIP), RTP (VoIP), SSH, POP3, NTP, IMAP4, TELNET, SMTP, SNMP 2/3, ICMP, IGMP and TLS.
76.02	Identify commonly used TCP and UDP default ports such as the following: TCP ports, FTP – 20, 21, SSH – 22, TELNET – 23, SMTP – 25, DNS – 53, HTTP – 80, POP3 – 110, NTP – 123, IMAP4 – 143, HTTPS – 443, UDP ports TFTP – 69, DNS – 53, BOOTPS/DHCP – 67 and SNMP – 161.
76.03	Identify the following address formats IPv6, IPv4, and MAC Addressing.
76.04	Evaluate the proper use of the following addressing technologies and addressing schemes: Subnetting, Classful vs. classless (e.g. CIDR, Supernetting), NAT, PAT, SNAT, Public vs. private, DHCP (static, dynamic APIPA), Addressing schemes, Unicast and Multicast, Broadcast.
76.05	Identify common IPv4 and IPv6 routing protocols - Link state OSPF, IS-IS, Distance vector, RIP, RIPv2, BGP and Hybrid EIGRP.
76.06	Explain the purpose and properties of routing such as IGP vs. EGP, Static vs. dynamic, Next Hop, Understanding routing tables and how they pertain to path selection, and explain convergence (steady state).
76.07	Compare the characteristics of wireless communication standards such as 802.11 a/b/g/n, speeds, distance, channels, frequency, authentication and encryption such as WPA, WEP, RADIUS and TKIP.
77.0	Understand, install, and configure network hardware. – The student will be able to:
77.01	Categorize standard cable types and their properties such as CAT3, CAT5, CAT5e, CAT6, STP, UTP, Multimode fiber, single-mode fiber, coaxial, serial, plenum vs non-plenum, transmission speeds, distance, duplex, noise immunity ( security, EMI), and frequency.
77.02	Identify common connector types such as RJ-11, RJ-45, BNC, SC, ST, LC and RS-232.
77.03	Identify common physical network topologies such as Star, Mesh, Bus, Ring, Point to Point, Point to Multipoint, and Hybrid.
77.04	Differentiate and implement appropriate wiring standards such as 568A, 568 B Straight vs cross over, rollover, and Loopback.
77.05	Categorize Wan technologies types and properties such as Frame Relay, E1/T1, ADSL, SDSL, VDSL, Cable modem, Satellite, E3/T3, Oc-x, Wireless, ATM, SONET, MPLS, ISD Bri, ISDN PRI, POTS, PSTN, Circuit, switch, packet switch, speed, transmission media, and Distance.
77.06	Categorize LAN technology types and properties such as Ethernet, 10BaseT, 100BaseTX, 100BaseFX, 1000BaseT, 1000BaseX, 10GbaseSR, 10GBaseLR, 10GBaseER, 10GBaseSW , 10GBaseLW, 10GBaseEW, 10GBaseT and properties of each such as CSMA/CD, Broadcast, Collision, Bonding, Speed, and Distance.
77.07	Explain common logical network topologies and their characteristics such as peer to peer, client/server, VPN and VLAN.
77.08	Install components of wiring distribution such as Vertical and horizontal cross connects, Patch panels, 66 block, MDFs, IDF, 25 pair, 100 pair, 110 block, Demarc, Demarc extension, Smart jack, verify wiring installation and Verify wiring termination.

78.0	Understand, install and configure networking devices. – The student will be able to:
78.01	Install, configure and differentiate between common network devices such as hub, repeater, modem, NIC, media converters, basic switch, bridge, wireless access point, basic router, basic firewall and basic DHCP server.
78.02	Identify the function of specialized network devices such as multilayer switch, Content switch, IDS/IPS, load balancer, multifunction network devices, DNS server Bandwidth shaper, proxy server, and CSU/DSU.
78.03	Explain the advance features of a switch such as PoE, Spanning tree, VLAN, Trunking, Port mirroring, and Port Authentication.
78.04	Implement a basic wireless network using the following technologies installed client, access point placement, access point with encryption, access point with configured channels and frequencies, and a set ESSSID and beacon.
79.0	Understand, install and configure network management software. – The student will be able to:
79.01	Explain the function of the OSI layer model such as physical, data link, network, transport, session, presentation and application.
79.02	Identifies types of configuration management documentation such as wiring schematics, physical and logical network diagram, baselines, policies, procedure and configuration and regulations.
79.03	Evaluate the network based on configuration management documentation such as compare wiring schematics, physical and logical network diagrams, baselines, policies and procedures, and configurations to network devices and infrastructure, and update wiring schematics, physical and logical network diagrams, configuration and job logs as needed.
79.04	Conduct network monitoring to identify performance and connectivity issues using the following: network monitoring utilities (packet sniffers, connectivity software, load testing, throughput testers) and system logs, history and event log.
79.05	Conduct network monitoring to identify performance and connectivity issues using the following: network monitoring utilities (packet sniffers, connectivity software, load testing, and throughput testers), system logs, history logs, and event logs.
79.06	Explain different methods and rationales for network performance optimization such as QoS, Traffic shaping, Load balancing, high availability, Caching engines, Fault tolerance, Latency sensitivity, High bandwidth applications, VoIP, Video applications, and Uptime.
79.07	Implement the following network troubleshooting methodology - Information gathering, identify symptoms and problems, Identify the affected areas of the network, Determine if anything has changed, Establish the most probable cause, Determine if escalation is necessary, Create an action plan and solution identifying potential effects, Implement and test the solution, Identify the results and effects of the solution, and Document the solution and the entire process.
79.08	Troubleshoot common connectivity issues and select an appropriate solution Physical issues: Cross talk, Near End crosstalk, Attenuation, collisions, Shorts Open, Impedance mismatch (echo), and Interference - Logical issues: Port speed, Port duplex mismatch, incorrect VLAN, Incorrect IP address, Wrong gateway, Wrong DNS, Wrong subnet mask, Issues that should be identified but escalated: Switching loop, Routing loop, Route problems, Proxy arp, Broadcast storms, Wireless Issues: Interference (bleed, environmental factors), incorrect encryption, Incorrect channel, Incorrect frequency, ESSID mismatch, Standard mismatch (802.11 a/b/g/n), Distance, Bounce, and Incorrect antenna placement.
80.0	Understand, install and configure networking tools. – The student will be able to:
80.01	Select the appropriate command line interface tool and interpret the output to verify functionality such as Traceroute, Ipconfig, IFconfig, Ping, Arp ping, Arp, Nslookup, Hostname, Dig, Mtr, Route, and Nbtstat.
80.02	Explain the purpose of network scanners such as Packet sniffers, Intrusion detection software, Intrusion prevention software and Port scanners.

80.03	Utilize the appropriate hardware tools such as Cable testers, Protocol analyzer, Certifiers, TDR, OTDR, Multimeter, Toner probe, Butt set, Punch down tool, Cable stripper, Snips, Voltage event recorder, and Temperature monitor.
81.0	Install, configure, and manage network security hardware and software devices. – The student will be able to:
81.01	Explain the function of hardware and software security devices such as Network based firewall, Host based firewall, IDS, IPS, and VPN concentrator.
81.02	Explain common features of a firewall for example: Application layer vs. network layer, Stateful vs. stateless, Scanning services, Content filtering, Signature identification, and Zones.
81.03	Explain the methods of network access security using the following: Filtering: ACL, MAC filtering, IP filtering, Tunneling and encryption, SSL VPN, VPN, L2TP, PPTP, IPSEC, Remote access, RAS, RDP, PPPoE, PPP, VNC, and ICA.
81.04	Explain methods of user authentication using the following methods: PKI, Kerberos, AAA, RADIUS, TACACS+, Network access control, 802.1x, CHAP, MS-CHAP, and EAP.
81.05	Explain issues that affect device security such as the Physical security, Restricting local and remote access, Secure methods vs. unsecure methods, SSH, HTTPS, SNMPv3, SFTP, SCP, and TELNET, HTTP, FTP, RSH, RCP and SNMPv1/2.
81.06	Identify common security threats and mitigation techniques such as Security threats, DoS, Viruses, Worms, Attackers, Man in the middle, murf, Rogue access points, Social engineering (phishing), Mitigation techniques, Policies and procedures, User training, Patches and updates.

**Course Number: CTS0068**  
**Occupational Completion Point: H**  
**Cybersecurity Essentials – 150 Hours – SOC Code 15-1151**

82.0	Demonstrate an understanding of cybersecurity, the terminology used, its history and culture, and trends. – The student will be able to:
82.01	Describe the history of cybersecurity, including the evolution of a hacker culture.
82.02	Discuss the trends and national initiatives related to cybersecurity.
82.03	Distinguish between information assurance and cybersecurity.
82.04	Describe the concepts of confidentiality as it relates to user and data impact.
82.05	Explain authentication and the concept of non-repudiation.
82.06	Describe the concept of “Hacking - The Human Element” and elaborate on its implications to cybersecurity.
83.0	Recognize the following types of malicious code and specify the appropriate actions to take to mitigate vulnerability and risk. – The student will be able to:
83.01	Describe viruses.
83.02	Identify Trojan Horses.
83.03	Explain Logic Bombs.
83.04	Describe worms.
83.05	Explain exploit kits.
83.06	Identify kill chains.
84.0	Recognize and be able to differentiate and explain the following access control models. – The student will be able to:
84.01	Define MAC (Mandatory Access Control).
84.02	Define DAC (Discretionary Access Control).
84.03	Define RBAC (Role Based Access Control).
85.0	Compare and contrast methods of authentication. – The student will be able to:
85.01	Identify Kerberos.
85.02	Explain CHAP (Challenge Handshake Authentication Protocol).
85.03	Define certificates.

85.04	Apply username / password.
85.05	Identify tokens.
85.06	Describe multi-factor.
85.07	Define mutual.
85.08	Define biometrics.
86.0	Recognize the following attacks and specify the appropriate actions to take to mitigate vulnerability and risk. – The student will be able to:
86.01	Explain DOS/DDOS (Denial of Service/Distributed Denial of Service).
86.02	Explain Back Door.
86.03	Identify spoofing.
86.04	Describe Man in the Middle.
86.05	Describe replay.
86.06	Explain TCP/IP Hijacking.
86.07	List Weak Keys.
86.08	Design password security measures to eliminate guessing (e.g., Brute Force, Dictionary, Mathematical, Social Engineering, Birthday).
86.09	Describe Software Exploitation.
87.0	The he processes and risks associated with the following security concerns and tasks. – The student will be able to:
87.01	Identify non-essential services and protocols and know what actions to take to reduce the risks of those services and protocols.
87.02	Understand the concept of and know how reduce the risks of social engineering.
87.03	Understand the concept and significance of auditing, logging and system scanning.
87.04	Identify and be able to differentiate different cryptographic standards and protocols.
88.0	The administration of the following types of remote access technologies. – The student will be able to:
88.01	Recognize 802.1x.
88.02	Understand VPN (Virtual Private Network).
88.03	Discuss RADIUS (Remote Authentication Dial-In User Service).

88.04	Describe TACACS (Terminal Access Controller Access Control System).
88.05	Generalize L2TP/PPTP (Layer Two Tunneling Protocol/Point to Point Tunneling Protocol).
88.06	Define SSH (Secure Shell).
88.07	Give examples of IPSEC (Internet Protocol Security).
88.08	List security vulnerabilities.
89.0	The administration of the following email security concepts. – The student will be able to:
89.01	Explain S/MIME (Secure Multipurpose Internet Mail Extensions).
89.02	Describe PGP (Pretty Good Privacy) like technologies.
89.03	List security vulnerabilities.
89.04	Identify SPAM.
89.05	Analyze hoaxes.
89.06	Track SMTP headers.
90.0	The administration of the following Internet security concepts. – The student will be able to:
90.01	Recognize SSL/TLS (Secure Sockets Layer/Transport Layer Security).
90.02	Understand HTTP/S (Hypertext Transfer Protocol/Hypertext Transfer Protocol over Secure Sockets Layer).
90.03	List security vulnerabilities.
91.0	The administration of the following vulnerabilities. – The student will be able to:
91.01	Discuss Java Script.
91.02	Explain ActiveX.
91.03	Identify Buffer Overflows.
91.04	Understand Cookies.
91.05	Explain Signed Applets.
91.06	Identify CGI (Common Gateway Interface).
91.07	Describe SMTP (Simple Mail Transfer Protocol) Relay.

92.0	The administration of the following directory security concepts. – The student will be able to:
92.01	Recognize SSL/TLS (Secure Sockets Layer/Transport Layer Security).
92.02	Recognize LDAP (Lightweight Directory Access Protocol).
93.0	The administration of the following file transfer protocols and concepts. – The student will be able to:
93.01	Identify S/FTP (File Transfer Protocol).
93.02	Identify Blind FTP (File Transfer Protocol)/Anonymous.
93.03	Understand File Sharing.
93.04	List security vulnerabilities.
94.0	The administration of the following wireless technologies and concepts. – The student will be able to:
94.01	Recognize WTLS (Wireless Transport Layer Security).
94.02	Recognize 802.11 and 802.11x.
94.03	Recognize WEP/WAP (Wired Equivalent Privacy/Wireless Application Protocol).
94.04	List security vulnerabilities.
95.0	Compare and contrast the following types of intrusion detection in terms of implementation and configuration. – The student will be able to:
95.01	Discuss Network Based – Active and Passive.
95.02	Discuss Host Based – Active and Passive.
95.03	Explain Honey Pots.
95.04	Describe Incident Response.
96.0	Be able to identify and explain the following different kinds of cryptographic algorithms. – The student will be able to:
96.01	Explain Hashing.
96.02	Explain Symmetric.
96.03	Explain Asymmetric.
97.0	Understand how cryptography and digital signatures address the following security concepts. – The student will be able to:
97.01	Discuss confidentiality.



97.02	Evaluate integrity.
97.03	Determine authentication.
97.04	Ensure non-repudiation.
97.05	Evaluate access control.
98.0	Understand the following concepts of PKI (Public Key Infrastructure). – The student will be able to:
98.01	Explain certificates (e.g., policies, practice statements).
98.02	Discuss revocation.
98.03	Identify trust models.
99.0	Understand the following concepts of Key Management and Certificate Lifecycles. – The student will be able to:
99.01	Compare and contrast centralized versus decentralized.
99.02	Compare and contrast hardware versus software key storage.
99.03	Explain private key storage.
99.04	Identify escrow.
99.05	Explain expiration.
99.06	Compare and contrast revocation versus suspension (e.g., status checking).
99.07	Interpret recovery authorization schema (e.g., M-of-N Control - Of M appropriate individuals, N must be present to authorize recovery).
99.08	Explain renewal.
99.09	Give examples of destruction.
99.10	Discuss key usage.
99.11	Compare and contrast multiple key pairs (Single, Dual).

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Enterprise Network and Server Support Technology  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

Career Certificate Program	
Program Number	Y300500
CIP Number	0511100123
Grade Level	30, 31
Standard Length	750 hours
Teacher Certification	Refer to the <b>Program Structure</b> section.
CTSO	SkillsUSA Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1122 Information Security Analysts 15-1142 Network and Computer Systems Administrators 15-1152 Computer Network Support Specialists
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

**Purpose**

The purpose of this program is to prepare students for employment or advanced training in a variety of occupations in the Information Technology industry.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the Information Technology industry; technical and product skills, underlying principles of technology, planning, management, finance, labor issues, community issues and health, safety, and environmental issues.

The content includes but is not limited to communication, leadership skills, human relations and employability skills; and safe, efficient work practices.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of two occupational completion points. When the recommended sequence is followed, the structure is intended to prepare students to complete the CompTIA Security+, the Certified Ethical Hacker, Cisco Certified Network Associate and the Microsoft Certified System Administrator industry certifications. A student who completes the applicable competencies at any occupational completion point may either continue with the training or become an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0099	Advanced Networking Fundamentals	BUS ED 1 @2	150 hour	15-1152
B	CTS0066	Information Technology Security Specialist <b>OR</b>	COMPU SCI 6	600 hour	15-1122
	CTS0094	Interconnecting Cisco Network Devices <b>OR</b>	COMP SVC 7G	600 hour	15-1142
	CTS0048	Microsoft Certified Systems Administrator	INFO TECH 7 G CYBER TECH 7 G ELECTRONIC @7 ?7 G	600 hour	15-1142

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify networks and components.
- 02.0 Describe the role of an Information Technology Security Specialist.
- 03.0 Describe the role of a Cisco Engineer.
- 04.0 Describe the role of a Microsoft Certified Systems Administrator.
- 05.0 Understand Cloud services.
- 06.0 Explore career options.
- 07.0 Demonstrate an understanding of Network Security.
- 08.0 Demonstrate Compliance and Operational Security.
- 09.0 Demonstrate an understanding of threats and vulnerabilities.
- 10.0 Demonstrate Use of Application, Data and Host Security.
- 11.0 Demonstrate proficiency and understanding of Access Control and Identity Management.
- 12.0 Demonstrate proficiency and understanding in Cryptography.
- 13.0 Demonstrate use of Ethical Hacking.
- 14.0 Demonstrate proficiency in Understanding the technical foundations of hacking.
- 15.0 Demonstrate an understanding of foot printing and scanning.
- 16.0 Demonstrate proficiency and understanding of enumeration and system hacking.
- 17.0 Demonstrate proficiency Linux and automated assessment tools.
- 18.0 Demonstrate understanding of Trojans and backdoors.
- 19.0 Demonstrate understanding of Sniffers, session hijacking, and denial of service.
- 20.0 Demonstrate understanding and proficiency in web server hacking, web application and database attack.
- 21.0 Demonstrate understanding and proficiency in wireless technologies, mobile security and attacks.
- 22.0 Demonstrate understanding and proficiency in configuring IDS, Firewalls, and Honeypots.
- 23.0 Explain use of buffer overflows, viruses, and worms.
- 24.0 Employing cryptographic attacks and defenses.
- 25.0 Demonstrate use of physical security and social engineering.
- 26.0 Describe the operation of data networks.
- 27.0 Demonstrate proficiency in LAN Switching Technologies.
- 28.0 Understand, IP addressing (IPv4/IPv6).
- 29.0 Demonstrate proficiency in IP Routing Technologies.
- 30.0 Demonstrate proficiency in IP Services.
- 31.0 Demonstrate proficiency in Network Device Security.
- 32.0 Demonstrate proficiency in Troubleshooting VLANs, Trunking and ACLs.
- 33.0 Demonstrate proficiency in LAN Switching Technologies.
- 34.0 Demonstrate proficiency in IP Routing Technologies.
- 35.0 Demonstrate proficiency in IP Services.
- 36.0 Demonstrate proficiency in troubleshooting network problems.
- 37.0 Demonstrate proficiency in WAN Technologies.
- 38.0 Demonstrate knowledge and skills in installing and configuring servers.
- 39.0 Demonstrate knowledge and skills in configuring server roles and features.

- 40.0 Demonstrate knowledge and skills in configuring Hyper-V.
- 41.0 Demonstrate knowledge and skills in deploying and configuring core network services.
- 42.0 Demonstrate knowledge and skills in installing and administering active Directory.
- 43.0 Demonstrate knowledge and skills in creating and managing Group Policy.
- 44.0 Demonstrate knowledge and skills in administering Windows Server.
- 45.0 Demonstrate knowledge and skills in configuring Advanced Windows Server Services.



Florida Department of Education  
 Student Performance Standards

Program Title: Enterprise Network and Server Support Technology  
 Career Certificate Program Number: Y300600

**Course Number: CTS0099**  
**Occupational Completion Point: A**  
**Advanced Networking Fundamentals – 150 Hours – SOC Code 15-1152**

1.0	Identify networks and components. – The student will be able to:
1.01	Research enterprise scenarios to determine network infrastructure.
1.02	Identify network components and relationships (cables, switches, software, power).
1.03	Identify typical equipment found in a MDF and IDF closet.
1.04	Identify business services that rely on a network or create network traffic (security, marketing, retail).
1.05	Design a network implementation plan for a small business enterprise.
2.0	Describe the role of an Information Technology Security Specialist. – The student will be able to:
2.01	Identify network security risks in an organization.
2.02	Analyze security risks for solutions.
2.03	Develop a security plan for a small business network.
2.04	Identify security standards both physical and computer software related.
3.0	Describe the role of a Cisco Engineer. – The student will be able to:
3.01	Identify switch and router technology being used in enterprise.
3.02	Investigate the configuration of switches and routers in an enterprise.
3.03	Develop a deployment plan for using network devices in enterprise.
3.04	Explain wireless connections and configuration for switches and routers.
3.05	Analyze (Switch/Router) price vs. performance in an enterprise.

4.0	Describe the role of a Microsoft Certified Systems Administrator. – The student will be able to:
4.01	Explain the importance system administration.
4.02	Identify key software and hardware being used for server administration.
4.03	Identify software and hardware considerations before deployment.
4.04	Develop a deployment plan for a small enterprise.
5.0	Understand Cloud services. – The student will be able to:
5.01	Identify clouds services currently available.
5.02	Compare and contrast the use of cloud services in an enterprise.
5.03	Identify hardware and software requirements for deploying a cloud service in an enterprise.
5.04	Develop a clouds services plan for a small enterprise.
6.0	Explore career options. – The student will be able to:
6.01	Identify job opportunities and qualifications needed to be a network security technician.
6.02	Identify job opportunities and qualifications needed to be a Cisco technician.
6.03	Identify job opportunities and qualifications needed to be Microsoft certified systems administrator.

**Course Number: CTS0066**  
**Occupational Completion Point: B**  
**Information Technology Security Specialist – 600 Hours – SOC Code 15-1122**

7.0 Demonstrate an understanding of Network Security. – The student will be able to:

7.01 Implement security configuration parameters on network devices and other technologies.

7.02 Given a scenario, use secure network administration principles (VLANs, Firewalls).

7.03 Explain various career options within the IT enterprise.

7.04 Given a scenario, implement common protocols and services (FTPS, DNS, Ports – 21-22-25).

7.05 Given a scenario, troubleshoot security issues related to wireless networking.

8.0 Demonstrate Compliance and Operational Security. – The student will be able to:

8.01 Explain the importance of risk related concepts.

8.02 Summarize the security implications of integrating systems and data with third parties.

8.03 Given a scenario, implement appropriate risk mitigation strategies.

8.04 Given a scenario, implement basic forensic procedures.

8.05 Summarize common incident response procedures.

8.06 Explain the importance of security related awareness and training.

8.07 Compare and contrast physical security and environmental controls.

8.08 Summarize risk management best practices.

8.09 Given a scenario, select the appropriate control to meet the goals of security (Encryption, Hashing).

9.0 Demonstrate an understanding of threats and vulnerabilities. – The student will be able to:

9.01 Explain types of malware (Viruses, Adware).

9.02 Summarize various types of attacks (DoS, DDoS, Smurf attack).

9.03 Summarize social engineering attacks and the associated effectiveness with each attack.

9.04 Explain types of wireless attacks.

9.05 Explain types of application attacks.

9.06	Analyze a scenario and select the appropriate type of mitigation and deterrent techniques.
9.07	Given a scenario, use appropriate tools and techniques to discover security threats and vulnerabilities.
9.08	Explain the proper use of penetration testing versus vulnerability scanning.
10.0	Demonstrate Use of Application, Data and Host Security. – The student will be able to:
10.01	Explain the importance of application security controls and techniques.
10.02	Summarize mobile security concepts and technologies.
10.03	Given a scenario, select the appropriate solution to establish host security.
10.04	Implement the appropriate controls to ensure data security.
10.05	Compare and contrast alternative methods to mitigate security risks in static environments.
11.0	Demonstrate proficiency and understanding of Access Control and Identity Management. – The student will be able to:
11.01	Compare and contrast the function and purpose of authentication services (RADIUS, TACACAS+, LDAP).
11.02	Given a scenario, select the appropriate authentication, authorization or access control.
11.03	Install and configure security controls when performing account management, based on best practices.
12.0	Demonstrate proficiency and understanding in Cryptography. – The student will be able to:
12.01	Given a scenario, utilize general cryptography concepts.
12.02	Given a scenario, use appropriate cryptographic methods.
12.03	Given a scenario, use appropriate PKI, certificate management and associated components.
13.0	Demonstrate use of Ethical Hacking. – The student will be able to:
13.01	Demonstrate security fundamentals.
13.02	Perform security testing.
13.03	Differentiate between hackers and crackers.
13.04	Identify ethical hackers.
13.05	Explain and implement testing plans.
13.06	Demonstrate proficiency with ethics and legality.

14.0	Demonstrate proficiency in Understanding the technical foundations of hacking. – The student will be able to:
14.01	Explain the Attacker’s process.
14.02	Explain the ethical hacker process.
14.03	Compare the relationship between security and the OSI model.
15.0	Demonstrate an understanding of foot printing and scanning. – The student will be able to:
15.01	Explain the seven-step information gathering process.
15.02	Identify active machines.
15.03	Demonstrate proficiency in finding open ports and access points.
15.04	Demonstrate use of OS fingerprinting.
15.05	Demonstrate proficiency in mapping the network attack surface.
16.0	Demonstrate proficiency and understanding of enumeration and system hacking. – The student will be able to:
16.01	Define enumeration.
16.02	Demonstrate proficiency in system hacking.
17.0	Demonstrate proficiency Linux and automated assessment tools. – The student will be able to:
17.01	Manage Linux OS.
17.02	Demonstrate proficiency in hacking Linux.
17.03	Demonstrate proficiency in hardening Linux.
17.04	Explain use of automated exploit tools.
18.0	Demonstrate understanding of Trojans and backdoors. – The student will be able to:
18.01	Explain the characteristics of Trojans.
18.02	Demonstrate proficiency in covert communication.
18.03	Explain keystroke logging and spyware characteristics.
18.04	Demonstrate understanding and proficiency in Trojan and backdoor countermeasures.
19.0	Demonstrate understanding of Sniffers, session hijacking, and denial of service. – The student will be able to:
19.01	Explain the functions and types of sniffers.

19.02	Explain session hijacking.
19.03	Demonstrate understanding of DoS, DDoS and Botnets.
20.0	Demonstrate understanding and proficiency in web server hacking, web application and database attack. – The student will be able to:
20.01	Explain webserver hacks.
20.02	Explain web application hacking.
20.03	Explain database hacking.
21.0	Demonstrate understanding and proficiency in wireless technologies, mobile security and attacks. – The student will be able to:
21.01	Explain different wireless technologies and attacks.
21.02	Understand and explain different wireless LANs technologies.
22.0	Demonstrate understanding and proficiency in configuring IDS, Firewalls, and Honeypots. – The student will be able to:
22.01	Explain and configure different types of IDSs.
22.02	Explain and configure different types of firewalls.
22.03	Explain and configure different types of honeypots.
23.0	Explain use of buffer overflows, viruses, and worms. – The student will be able to:
23.01	Explain buffer overflows, buffer overflows attacks, and prevention.
23.02	Define the use of viruses and worms.
24.0	Employing cryptographic attacks and defenses. – The student will be able to:
24.01	Explain functions of cryptography.
24.02	Report the history of cryptography.
24.03	Identify different algorithms.
24.04	Identify digital signature.
24.05	Explain steganography operation.
24.06	Use steganographic tools.
24.07	Create a digital watermark.

24.08	Use digital certificates.
24.09	Explain public key infrastructure.
24.10	Define protocols, standards, and applications.
24.11	Use encryption-cracking tools.
25.0	Demonstrate use of physical security and social engineering. – The student will be able to:
25.01	Apply physical security measures.
25.02	Define social engineering types, attacks and preventive measures.

**Course Number: CTS0094**  
**Occupational Completion Point: B**  
**Interconnecting Cisco Network Devices - 600 Hours – SOC Code 15-1142**

26.0 Describe the operation of data networks. – The student will be able to:

26.01 Recognize the purpose and functions of various network devices such as routers, switches, bridges and hubs.

26.02 Select the components required to meet a given network specification.

26.03 Identify common applications and their impact on the network.

26.04 Describe the purpose and basic operation of the protocols in the OSI and TCP/IP models.

26.05 Predict the data flow between two hosts across a network.

26.06 Identify the appropriate media, cables, ports, and connectors to connect Cisco network devices to other network devices and hosts in a LAN.

27.0 Demonstrate proficiency in LAN Switching Technologies. – The student will be able to:

27.01 Determine the technology and media access control method for Ethernet networks.

27.02 Identify basic switching concepts and the operation of Cisco switches.

27.03 Configure and verify initial switch configuration including remote access management.

27.04 Describe how VLANs create logically separate networks and the need for routing between them.

27.05 Configure and verify VLANs.

27.06 Configure and verify trunking on Cisco switches.

28.0 Understand, IP addressing (IPv4/IPv6) – The student will be able to

28.01 Describe the operation and necessity of using private and public IP addresses for IPv4 addressing.

28.02 Identify the appropriate IPv6 addressing scheme to satisfy addressing requirements in a LAN/WAN environment.

28.03 Identify the appropriate IPv4 addressing scheme using VLSM and summarization to satisfy addressing requirements in a LAN/WAN environment.

28.04 Describe the technological requirements for running IPv6 in conjunction with IPv4.

28.05 Describe IPv6 addresses.

29.0 Demonstrate proficiency in IP Routing Technologies. – The student will be able to:



29.01	Describe basic routing concepts.
29.02	Configure and verify utilizing the CLI to set basic Router configuration.
29.03	Configure and verify operation status of an Ethernet interface.
29.04	Verify router configuration and network connectivity using.
29.05	Configure and verify routing configuration for a static or default route given specific routing requirements.
29.06	Differentiate methods of routing and routing protocols.
29.07	Configure and verify OSPF (single area).
29.08	Configure and verify interVLAN routing (router on a stick).
29.09	Configure SVI interfaces.
30.0	Demonstrate proficiency in IP Services. – The student will be able to:
30.01	Configure and verify DHCP (IOS router).
30.02	Describe the types, features, and applications of ACLs.
30.03	Configure and verify ACLs in a network environment.
30.04	Identify the basic operation of NAT.
30.05	Configure and verify NAT for given network requirements.
30.06	Configure and verify NTP as a client.
31.0	Demonstrate proficiency in Network Device Security – The student will be able to:
31.01	Configure and verify network device security features.
31.02	Configure and verify switch port security.
31.03	Configure and verify ACLs to filter network traffic.
31.04	Configure and verify ACLs to limit telnet and SSH access to the router.
32.0	Demonstrate proficiency in Troubleshooting VLANs, Trunking and ACLs. – The student will be able to:
32.01	Troubleshoot and correct common problems associated with IP addressing and host configurations.

32.02	Troubleshoot and resolve VLAN problems.
32.03	Troubleshoot and resolve trunking problems on Cisco switches.
32.04	Troubleshoot and resolve ACL issues.
33.0	Demonstrate proficiency in LAN Switching Technologies. – The student will be able to:
33.01	Identify enhanced switching technologies (RSTP, PRSTP, VSTP, Etherchannels).
33.02	Configure and verify PVSTP operation.
34.0	Demonstrate proficiency in IP Routing Technologies – The student will be able to:
34.01	Describe the boot process of Cisco IOS routers.
34.02	Configure and verify the operation status of a serial interface.
34.03	Manage Cisco IOS files.
34.04	Differentiate methods of routing and routing protocols.
34.05	Configure and verify OSPF (multi-area).
34.06	Configure and verify EIGRP (single AS).
34.07	Passive Interface.
35.0	Demonstrate proficiency in IP Services – The student will be able to:
35.01	Recognize high availability (FHRP).
35.02	Configure and verify syslog.
36.0	Demonstrate proficiency in troubleshooting network problems. – The student will be able to:
36.01	Identify and correct common network problems.
36.02	Utilize netflow data.
36.03	Troubleshoot and resolve spanning tree operation issues.
36.04	Troubleshoot and resolve routing issues.
36.05	Troubleshoot and resolve OSPF problems.
36.06	Troubleshoot and resolve EIGRP problems.

36.07	Troubleshoot and resolve inter VLAN routing problems.
36.08	Troubleshoot and resolve WAN implementation issues.
36.09	Monitor NetFlow statistics.
36.10	TS etherchannel problems.
37.0	Demonstrate proficiency in WAN Technologies. – The student will be able to:
37.01	Identify different WAN Technologies.
37.02	Configure and verify a basic WAN serial connection.
37.03	Configure and verify a PPP connection between Cisco routers.
37.04	Configure and verify Frame Relay on Cisco routers.
37.05	Implement and troubleshoot PPPoE.

**Course Number: CTS0048**  
**Occupational Completion Point: B**  
**Microsoft Certified Systems Administrator – 600 Hours – SOC Code 15-1142**

38.0 Demonstrate knowledge and skills in installing and configuring servers. – The student will be able to:

38.01 Plan for a server installation, plan for server roles, plan for a server upgrade, install Server Core, optimize resource utilization by using Features on Demand, migrate roles from previous versions of Windows Server.

38.02 Design and configure storage solutions.

39.0 Demonstrate knowledge and skills in configuring server roles and features. – The student will be able to:

39.01 Create and configure shares and share permissions.

39.02 Configure and manage print services.

39.03 Configure WinRM, configure down-level server management, configure servers for day-to-day management tasks, configure multi-server management, configure Server Core, configure Windows Firewall, manage non-domain joined servers.

40.0 Demonstrate knowledge and skills in configuring Hyper-V –The student will be able to:

40.01 Create and configure virtual machine settings.

40.02 Create and configure virtual machine storage.

40.03 Create and configure virtual networks.

41.0 Demonstrate knowledge and skills in deploying and configuring core network services – The student will be able to:

41.01 Configure IPv4 and IPv6 addressing.

41.02 Deploy and configure Dynamic Host Configuration Protocol (DHCP) service.

41.03 Deploy and configure DNS service.

41.04 Configure Active Directory integration of primary zones, configure forwarders, configure Root Hints, manage DNS cache, create A and PTR resource records.

42.0 Demonstrate knowledge and skills in installing and administering active Directory – The student will be able to:

42.01 Install and configure domain controllers.

42.02 Create and manage Active Directory users and computers.

42.03 Create and manage Active Directory groups and organizational units (OUs).

43.0 Demonstrate knowledge and skills in creating and managing Group Policy – The student will be able to:

43.01	Create and configure Group Policy objects (GPOs).
43.02	Configure security policies.
43.03	Configure application restriction policies.
43.04	Configure Windows Firewall.
44.0	Demonstrate knowledge and skills in administering Windows Server – The student will be able to:
44.01	Deploy and manage server images.
44.02	Install and configure the Windows Server Update Services (WSUS) role.
44.03	Configure Data Collector Sets (DCS).
44.04	Configure file and print services (DFS).
44.05	Configure file and disk encryption.
44.06	Configure network services and access.
44.07	Configure DNS zones and records.
44.08	Configure virtual private network (VPN) and routing.
44.09	Configure DirectAccess: Implement server requirements, implement client configuration, configure DNS for Direct Access, configure certificates for Direct Access.
44.10	Configure a Network Policy Server (NPS) infrastructure and policies.
44.11	Configure Network Access Protection (NAP).
45.0	Demonstrate knowledge and skills in configuring Advanced Windows Server Services – The student will be able to:
45.01	Configure and manage high availability.
45.02	Configure failover clustering.
45.03	Configure file and storage solutions (Network File System, FSRM).
45.04	Implement business continuity and disaster recovery (Backups, Fault Tolerance).
45.05	Configure Advanced Network services (DHCP, DNS, IPAM).
45.06	Configure the Active Directory Infrastructure (Forests, Multi-Domain).
45.07	Configure Identity Access Solutions (AD FS, AD CS, CA).

45.08 Manage certificates.

45.09 Install and configure Active Directory Rights Management Services (AD RMS).

45.10 Manage and Configure System Center Configuration Manager.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement

(Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

### **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.



**Florida Department of Education  
Curriculum Framework**

**Program Title:** Enterprise Desktop and Mobile Support Technology  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

<b>Career Certificate Program</b>	
Program Number	Y300600
CIP Number	0511100124
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <b>Program Structure</b> section.
CTSO	SkillsUSA Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 Computer User Support Specialists 15-1152 Computer Network Support Specialists
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

**Purpose**

The purpose of this program is to prepare students for employment or advanced training in a variety of occupations in the information technology industry.

This program focuses on broad, transferable skills and stresses understanding and demonstration of the following elements of the information technology industry; technical and product skills, underlying principles of technology , planning, management, finance, labor issues, community issues and health, safety, and environmental issues.

The content includes but is not limited to communication, leadership skills, human relations and employability skills; and safe, efficient work practices.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

## Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points. When the recommended sequence is followed, the structure is intended to prepare students to complete the CompTIA A+ and Network+ industry certifications. A student who completes the applicable competencies at any occupational completion point may either continue with the training or become an occupational completer.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0000	Computer Hardware Fundamentals	BUS ED 1 @2 COMPU SCI 6 COMP SVC 7G INFO TECH 7 G CYBER TECH 7 G ELECTRONIC @7 7 G	150 hours	15-1151
	CTS0001	Operating System Fundamentals		150 hours	15-1151
B	CTS0002	Advanced Operating Systems		150 hours	15-1151
	CTS0003	Mobile-Security-Domain Environment Fundamentals		150 hours	15-1151
C	CTS0005	Desktop Support Technician		150 hours	15-1151
D	CTS0020	Network Fundamentals		150 hours	15-1152
	CTS0033	Network Technician	150 hours	15-1152	

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## **Standards**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Identify characteristics of medium size enterprise information systems as a business unit and its critical role and purpose in successful and efficient business operation.
- 02.0 Demonstrate proficiency using enterprise-class computer/devices connectors, jacks, plugs, cables and their function, versions and purpose.
- 03.0 Demonstrate proficiency with motherboards, CPU options, system components, BIOS types and BIOS-UEFI configurations options.
- 04.0 Demonstrate proficiency with tools, ESD concepts-procedures, personal and equipment safety and chemicals related to maintenance and repair of computers, mobile devices, peripherals, printers and network devices.
- 05.0 Demonstrate an understanding of storage, video, audio, display, and network-cellular found in the business/enterprise.
- 06.0 Demonstrate proficiency in building a basic PC system using standard components, following best practices in equipment and personal safety, following manufactures' procedures and steps for every component involved in the system.
- 07.0 Demonstrate proficiency with installation and configuration of enterprise desktop-laptop operating systems.
- 08.0 Demonstrate proficiency installing and configuring expansion cards, RAM, storage devices, video adapters, audio, and a variety of system components.
- 09.0 Demonstrate proficiency in installing, updating and troubleshooting drivers in desktop-laptop-tablet devices.
- 10.0 Demonstrate proficiency with PC Laptop specification for purchase—Laptop systems for a variety of corporate functions such as, basic desktop user, CAD, CAE, video-audio editing and client-side virtualization.
- 11.0 Demonstrate the importance of health, safety, and environmental procedures in organizations and their importance to organizational and personal performance and regulatory compliance.
- 12.0 Demonstrate proficiency in connecting, configuring and troubleshooting multi-displays, data projectors, smart boards, and document cameras and kiosks systems.
- 13.0 Demonstrate proficiency of installing, configuring and troubleshooting enterprise desktop-laptop operating systems in a network environment.
- 14.0 Demonstrate proficiency of installing and configuring and troubleshooting variety of business applications in a network environment.
- 15.0 Demonstrate proficiency in configuring and troubleshooting basic desktop, laptop network connectivity, including software, services, cables, switches, and access points.
- 16.0 Understanding the fundamentals of active directory domains, organization units, the role of computers and users in that environment and how the technician interacts with this secure environment.
- 17.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment.
- 18.0 Describe the importance of professional ethics and legal responsibilities.
- 19.0 Explain and demonstrate the basic features of mobile operating systems.
- 20.0 Establish mobile network connectivity and configure email, and applications and configure application synchronization.
- 21.0 Configure, compare and contrast methods for mobile security and hardware platforms.
- 22.0 Identify and enterprise attack vectors, remove malware, viruses, and other security risk software from desktops, laptop, and mobile devices.
- 23.0 Demonstrate proficiency identifying, and mitigating malicious threats using social and human elements in the workplace.
- 24.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives.
- 25.0 Identify and compare and contrast business type printers.
- 26.0 Install, configure and troubleshooting directly connected printers and share to the local network.
- 27.0 Install, configure and troubleshooting server-based printers and validate the clients printing functionality.
- 28.0 Demonstrate command-line fundamentals, including hard drive navigation, network tools, basic scripts and the fundamentals of PowerShell.
- 29.0 Demonstrate proficiency in share permissions and file and folder security including fundamentals of domain users, local users, groups in an active directory environment.

- 30.0 Demonstrate the fundamentals of network architectural structure of LANs, fundamentals and roles of the network switch, router and WAN.
- 31.0 Demonstrate proficiency in tools and equipment for troubleshooting network connectivity.
- 32.0 Demonstrate the use of network services including DNS, DHCP, cellular, cloud services and applications.
- 33.0 Demonstrate the fundamentals TCP/IP, OSI and Internet models of network layer addressing.
- 34.0 Setup and configure basic VoIP telephony functionality for business users.
- 35.0 Setup and configure VPN on desktop, tablet, and laptop platforms.
- 36.0 Demonstrate proficiency installing, configuring, and troubleshooting management system agents, anti-virus, group policy objects, operating systems and applications updates.
- 37.0 Demonstrate proficiency in installing, configuring and troubleshooting client-side virtualization.
- 38.0 Demonstrate proficiency with different operating systems.
- 39.0 Demonstrate proficiency of user data backup, configuration, and recovery.
- 40.0 Demonstrate troubleshooting of PC and laptop hardware failures.
- 41.0 Demonstrate troubleshooting of PC-laptop boot failures, BSOD, shutdown, devices failing to start, missing DLL message.
- 42.0 Describe the operation of data networks.
- 43.0 Differentiate between various network media and topologies.
- 44.0 Identify, install, and configure basic network devices.
- 45.0 Implement an IP addressing scheme to meet network requirements.
- 46.0 Demonstrate use of network management tasks and methodologies.
- 47.0 Demonstrate proficiency using basic network tools.
- 48.0 Demonstrate an understanding of network security threats and mitigation techniques.
- 49.0 Configure, verify and troubleshoot a switch with VLANs and interswitch communications.
- 50.0 Implement an IP addressing scheme and IP Services to meet network requirements in a medium-size Enterprise branch office network.
- 51.0 Understand basic router operation.
- 52.0 Demonstrate Proficiency with configuring and troubleshooting a WLAN.
- 53.0 Demonstrate Proficiency with configuring and troubleshooting a Server.
- 54.0 Demonstrate Proficiency with configuring and troubleshooting a VPN.
- 55.0 Demonstrate Proficiency with configuring and troubleshooting a VOIP.
- 56.0 Demonstrate Proficiency with configuring and troubleshooting Virtualization.

Florida Department of Education  
 Student Performance Standards

Program Title: Enterprise Desktop and Mobile Support Technology  
 Career Certificate Program Number: Y300500

<b>Course Number: CTS0000</b>	
<b>Occupational Completion Point: A</b>	
<b>Computer Hardware Fundamentals – 150 Hours – SOC Code 15-1151</b>	
01.0	Identify characteristics of medium size enterprise information systems as a business unit and its critical role and purpose in successful and efficient business operation. – The student will be able to:
01.01	Identify business unit structures (operations, accounting) in most medium and large enterprise.
01.02	Describe the relationship between enterprise business units and IT unit.
01.03	Summarize various career options within the IT enterprise (Help Desk, Tier 1, Tier 2, Server Administrator).
01.04	Analyze and report on IT budgets, project management, IT services, and IT innovation.
01.05	Evaluate and justify the role and importance of IT within medium and large enterprise companies.
02.0	Demonstrate proficiency using enterprise-class computer/devices connectors, jacks, plugs, cables and their function, versions and purpose. – The student will be able to:
02.01	Identify legacy and current technology connectors, jacks and cables for PCs, tablets, laptops and smart phones.
02.02	Determine function and identify versions of connectors, jacks and plugs on enterprise type motherboards, laptops, tablets and smart phones.
03.0	Demonstrate proficiency with motherboards, CPU options, system components, BIOS types and BIOS-UEFI configurations options. – The student will be able to:
03.01	Classify motherboard form factors, motherboard components, types and features.
03.02	Classify internal power supplies types, characteristics and connectors.
03.03	Explain the purpose CPUs, characteristics and features.
03.04	Compare and contrast CPU cooling technology for components and devices.
03.05	Compare and contrast memory types, characteristics and purpose.
03.06	Identify and explain the functions of internal storage technologies.
03.07	Compare features of BIOS vs UEFI as related to advanced functionality and security.
03.08	Identify and explain the importance of TPM and hardware based security in enterprise devices.

03.09	Demonstrate firmware upgrades, device tracking configuration, and password protection of devices.
04.0	Demonstrate proficiency with tools, ESD concepts-procedures, personal and equipment safety and chemicals related to maintenance and repair of computers, mobile devices, peripherals, printers and network devices. – The student will be able to:
04.01	Given a scenario use the appropriate tools in the repair and maintenance of desktops.
04.02	Demonstrate personal safety procedures during the repair of electronic equipment, proper battery handling and storage.
04.03	Demonstrate use of ESD protection including: wrist straps, ESD mats, self-grounding, and equipment grounding.
04.04	Describe chemical SDS forms, demonstrate how to implement safety procedures, and demonstrate steps emergency aid in the event of mistakes in the use of the chemical.
04.05	Identify tools and appropriate use of tools in the repair of mobile devices, peripherals, printers and network devices.
05.0	Demonstrate an understanding of storage, video, audio, display, and network-cellular found in the business/enterprise. – The student will be able to:
05.01	Identify and explain the purpose of storage types, technologies and proper implementation of storage types and technology in the support of enterprise users. SATA, SATA express, SAS, SCSI, NVMe, SSD Hard Drive, Hybrid Hard Drives, Spindle-based Hard Drives, Flash-based storage, SD, RAID technologies, Cloud-based storage options, Optical based storage.
05.02	Identify common video display technologies describe use/implementation in enterprise.
05.03	Identify common audio technologies and describe the use/implementation in enterprise.
05.04	Identify common display technologies describe the use/implementation in enterprise. Multi-displays, LCD, LED, OLED.
05.05	Identify common network-cellular technologies and describe the use/implementation in enterprise. WiFi 802.11x, Wired Ethernet, Cellular technologies, Bluetooth, RFID, NFC.
06.0	Demonstrate proficiency in building a basic PC system using standard components, following best practices in equipment and personal safety, following manufactures' procedures and steps for every component involved in the system. – The student will be able to:
06.01	Demonstrate the ability to read and understand OEM technical documentation, manuals, diagrams and procedures.
06.02	Demonstrate proper handling and installation of CPU, motherboard, adapters, and power supplies in the PC enclosure/case.
06.03	Demonstrate understanding of thermal monitoring, stress testing of components, and benchmarks for performance.
06.04	Demonstrate installation of a basic operating system on a storage device.

**Course Number: CTS0001**  
**Occupational Completion Point: A**  
**Operating System Fundamentals – 150 Hours – SOC Code 15-1151**

07.0	Demonstrate proficiency with installation and configuration of enterprise desktop-laptop operating systems. – The student will be able to:
07.01	Demonstrate the technology and procedures for network-based, flash drive, and image-based operating system installs.
07.02	Demonstrate the creation and use of answer-file based operating systems installs using either network file shares or flash drives.
07.03	Demonstrate installation of operating systems using sysprep, cloning software and basic scripts to do basic configurations.
08.0	Demonstrate proficiency installing and configuring expansion cards, RAM, storage devices, video adapters, audio, and a variety of system components. – The student will be able to:
08.01	Demonstrate proper procedures while following OEM documentation on the installation of variety of expansion cards.
08.02	Demonstrate proper procedures while following OEM documentation when upgrading RAM.
08.03	Demonstrate proper procedures while following OEM documentation when upgrading and configuring a variety of storage devices and storage configurations.
08.04	Compare and contrast RAID scenarios used by enterprise for specialty functions (video editing, CAD, CAE).
08.05	Demonstrate proper procedures while following OEM documentation when upgrading and configuring a variety of video adapters.
09.0	Demonstrate proficiency in installing, updating and troubleshooting drivers in desktop-laptop-tablet devices. – The student will be able to:
09.01	Explain the purpose and function of signed drivers, compare generic drivers with OEM drivers and properly choose the correct one given any scenario.
09.02	Demonstrate proficiency with installing configuring, troubleshooting and updating device drivers in desktops, laptops, and other mobile devices.
10.0	Demonstrate proficiency with PC Laptop specification for purchase–Laptop systems for a variety of corporate functions such as, basic desktop user, CAD, CAE, video-audio editing and client-side virtualization. – The student will be able to:
10.01	Properly select display adapters, CPU, storage needs, audio functionally, and motherboard for CAD and CAE workstations and laptops.
10.02	Properly select display adapters, CPU, storage needs, audio functionally, and motherboard for video-audio editing workstations and laptops.
10.03	Properly select display adapters, CPU, storage needs, audio functionally, and motherboard for client-side virtualization workstations and laptops.
11.0	Demonstrate the importance of health, safety, and environmental procedures in organizations and their importance to organizational and personal performance and regulatory compliance. – The student will be able to:
11.01	Demonstrate knowledge of the business procedures and processes for appropriate personal and equipment safety within the workspace.
11.02	De-energizing equipment, tag-out procedures, lifting techniques, weight limitations, electrical fire safety, removal of personal jewelry.
11.03	Demonstrate knowledge of business and security procedures for disposal of any storage device with corporate or personal data on it.



11.04	Demonstrate knowledge of procedures for disposal of any electronic device, batteries, chemicals that meet local, state and federal compliance regulations.
12.0	Demonstrate proficiency in connecting, configuring and troubleshooting multi-displays, data projectors, smart boards, and document cameras and kiosks systems. – The student will be able to:
12.01	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting multi-display systems.
12.02	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting data-projector systems.
12.03	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting smart boards systems.
12.04	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting kiosk systems.
12.05	Demonstrate proper procedures and steps, following OEM documentation, while connecting, configuring and troubleshooting document camera systems.

**Course Number: CTS0002**

**Occupational Completion Point: B**

**Advanced Operating Systems – 150 Hours – SOC Code 15-1151**

13.0	Demonstrate proficiency of installing, configuring and troubleshooting enterprise desktop-laptop operating systems in a network environment. – The student will be able to:
13.01	Describe the configuration and setup of network-based operating systems installation, flash drive installation and imaging.
13.02	Demonstrate the installation of an operating system using answer files, sysprep, clone tools and basic scripts for configuration.
13.03	Demonstrate understanding of users and groups configurations, management agents, and user's rights for enterprise desktops and laptops.
13.04	Demonstrate built-in operating system utilities for configuring and managing services, devices, performance, and disks.
13.05	Demonstrate built-in operating system utilities for configuring and managing scheduled tasks.
13.06	Demonstrate built-in operating system utilities user configuration, registry modification, user migration, system configuration and local security policies.
13.07	Employ built-in operating system administrative utilities for configuration and troubleshooting.
13.08	Explain operating system processes, threads, DLLs, security, and parent child relationships within the operating system.
13.09	Troubleshoot locked processes, processes that demand excessive resources, and processes that may need updates or developer intervention.
13.10	Remotely troubleshoot operating systems using RDC, built-in utilities, and web-based remote access tools.
13.11	Demonstrate the bare-metal backup and recovery on an operating system.
14.0	Demonstrate proficiency of installing and configuring and troubleshooting variety of business applications in a network environment. – The student will be able to:
14.01	Demonstrate the proper installation of typical user applications.
14.02	Demonstrate basic scripting during the installation of typical applications.
14.03	Demonstrate troubleshooting steps and procedures for typical business applications, including desktop apps, modern apps, and cloud-based applications.
14.04	Compare and explain the differences and similarities of desktop applications, modern applications and cloud-based applications.
15.0	Demonstrate proficiency in configuring and troubleshooting basic desktop, laptop network connectivity, including software, services, cables, switches, and access points. – The student will be able to:
15.01	Describe the characteristics and identify various network cables and connectors used in the enterprise.
15.02	Compare wireless standards and configurations needed for accessing APs.
15.03	Describe the fundamentals of an Ethernet based LAN, the role of switches in user connectivity to the LAN.

15.04	Identify fundamental services and key components for networking in the operating system.
15.05	Explain static and dynamic IP addressing, and fundamentals of network connectivity between switches and NICs, wireless NICs and access points.
15.06	Configure and troubleshoot basic network connectivity for both desktops and laptops to wired and wireless network connection.
16.0	Understanding the fundamentals of active directory domains, organization units, the role of computers and users in that environment and how the technician interacts with this secure environment. – The student will be able to:
16.01	Explain the fundamental structure, purpose and function of active directory.
16.02	Explain the purpose and relationship of domain users and groups and computer membership in a domain environment.
16.03	Join computers to a domain, add domain users to local groups and explain the impact on the operating system and user rights.
16.04	Given a user, business need, and security requirement show how GPOs impact the function of the operating system.
16.05	Given a scenario apply a GPO to users and computers that effectively meets the criteria of the scenario.
17.0	Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. – The student will be able to:
17.01	Describe the nature and types of business organizations.
17.02	Explain the effect of key organizational systems on performance and quality.
17.03	List and describe quality control systems and/or practices common to the workplace.
17.04	Explain the impact of the global economy on business organizations.
18.0	Describe the importance of professional ethics and legal responsibilities. – The student will be able to:
18.01	Evaluate and justify decisions based on ethical reasoning.
18.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.
18.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.
18.04	Interpret and explain written organizational policies and procedures.

**Course Number: CTS0003**

**Occupational Completion Point: B**

**Mobile-Security-Domain Environment Fundamentals – 150 Hours – SOC Code 15-1151**

19.0	Explain and demonstrate the basic features of mobile operating systems. – The student will be able to:
19.01	Compare and contrast the significant mobile operating systems as open source vs vendor specific, its impact on applications sources, its fundamental operations and interface.
19.02	Explain the various enterprise BYOD policies found in the local area, their impact on the user and security policies of company data.
19.03	Demonstrate the ability to navigate and locate administration functionality on different hardware platforms and different operating systems.
20.0	Establish mobile network connectivity and configure email, and applications and configure application synchronization. – The student will be able to:
20.01	Configure fundamental settings for a user from a default state on a mobile operating system.
20.02	Add, configure and troubleshoot mobile applications.
20.03	Enable, configure and troubleshoot Bluetooth, NFC, wireless and cellular networks.
20.04	Configure synchronization with email systems and other critical business type applications and cloud-based providers.
20.05	Configure VPN for mobile devices.
21.0	Configure, compare and contrast methods for mobile security and hardware platforms. – The student will be able to:
21.01	Compare and contrast security methods for different operating systems and hardware.
21.02	Compare and contrast security methods for Passcode locks.
21.03	Compare and contrast security methods for Log on security methods.
21.04	Compare and contrast security methods for Remote wipes.
21.05	Compare and contrast security methods for Locator applications.
21.06	Compare and contrast security methods for Patching/OS updates.
21.07	Configure various types of user and device security on mobile operating systems.
22.0	Identify and enterprise attack vectors, remove malware, viruses, and other security risk software from desktops, laptop, and mobile devices. – The student will be able to:
22.01	Compare contrast common security threats.
22.02	Explain the use of malware, rootkits, phishing, shoulder surfing, spyware, app vulnerability.
22.03	Install and configure anti-virus and anti-malware software.

22.04	Implement security best practices.
22.05	Demonstrate setting strong passwords, changing default user names/passwords, disabling unused users, restricting user rights.
22.06	Demonstrate safe storage device sanitation: wipe, physical destruction, out-source for recycle and sanitation.
22.07	Establish and configure strong wireless security standards.
22.08	Using third party tools both installed and offline, detect malicious code and remove such code, using proper procedures for protecting user data.
23.0	Demonstrate proficiency identifying, and mitigating malicious threats using social and human elements in the workplace. – The student will be able to:
23.01	Identify and implement physical security prevention methods.
23.02	Explain access control, physical document securing, tailgating, biometrics, badges, key fobs, privacy filters and retinal identification.
23.03	Explain the importance of “principle of least privilege” and “user education” in the overall company security policy.
23.04	Identify the “human” element within each company and the principles behind social engineered attacks.
23.05	Assess digital security.
23.06	Setup firewall, anti-virus, network access policies, user authentication, directory permissions.
23.07	Given a social engineered attack scenario, use proper procedures to identify the threat and mitigate the threat.
24.0	Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. – The student will be able to:
24.01	Employ leadership skills to accomplish organizational goals and objectives.
24.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.
24.03	Conduct and participate in meetings to accomplish work tasks.
24.04	Employ mentoring skills to inspire and teach others.
25.0	Identify and compare and contrast business type printers. – The student will be able to:
25.01	Explain the principles of the xerographic process used by all laser and copy devices.
25.02	Compare and contrast the impact, thermal, and inkjet printer technologies.
25.03	Compare and contrast types of paper used by a variety of business type printers.
26.0	Install, configure and troubleshooting directly connected printers and share to the local network. – The student will be able to:
26.01	Install, configure and troubleshoot typical MFP printers to a local host.

26.02	Demonstrate setup for printing, fax, copy and scan.
26.03	Install and configure a printer via, wireless, and connect mobile apps for control of printer/scanner functions.
26.04	Perform basic printer maintenance.
26.05	Share and secure hosted printers and troubleshoot printer and network connectivity issues.
27.0	Install, configure and troubleshooting server-based printers and validate the clients printing functionality. – The student will be able to:
27.01	Install, configure and troubleshoot server-hosted printer.
27.02	Configure basic printer security and policies and user access.
27.03	Connect and configure and test client access and functionality to printer.

**Course Number: CTS0005**

**Occupational Completion Point: C**

**Desktop Support Technician – 150 Hours – SOC Code 15-1151**

28.0 Demonstrate command-line fundamentals, including hard drive navigation, network tools, basic scripts and the fundamentals of PowerShell. – The student will be able to:

28.01 Demonstrate hard drive and directory navigation with command-line and PowerShell.

28.02 Demonstrate basic utilities for managing files, folders, operating system and network using command-line or PowerShell interfaces.

28.03 Setup logon and logoff scripts and basic use of various types of scripts to manage desktops.

29.0 Demonstrate proficiency in share permissions and file and folder security including fundamentals of domain users, local users, groups in an active directory environment. – The student will be able to:

29.01 Demonstrate the fundamentals of shares and share permissions, file and folder security and the interaction between the two.

29.02 Demonstrate the fundamentals of users and groups in their role of share permissions and file and folder security.

29.03 Given a scenario, properly configure and set share, file and folder security for users and group combinations.

30.0 Demonstrate the fundamentals of network architectural structure of LANs, fundamentals and roles of the network switch, router and WAN. – The student will be able to:

30.01 Explain the basic structure of extended star Ethernet LANs, identify the MDF and IDF roles.

30.02 Explain the ISP/WAN connectivity, devices and basic security structure.

30.03 State the role of the router.

30.04 State the role of switches, VLANs, PoE and switch interconnection in a basic LAN.

30.05 Explain the fundamentals network devices and their functions.

30.06 Define NAS, Bridge, Modem, router, firewall.

31.0 Demonstrate proficiency in tools and equipment for troubleshooting network connectivity. – The student will be able to:

31.01 Use a variety of tools for network cables and connectors and punch downs.

31.02 Use cable tone and probe tools.

31.03 Use loopback adapters for troubleshooting and various network adapters for cable crossovers.

32.0 Demonstrate the use of network services including DNS, DHCP, cellular, cloud services and applications. – The student will be able to:

32.01 Explain fundamental LAN network services: DNS, DHCP, and WINS.

32.02	Explain the fundamentals of cellular systems and their role in network and application connectivity.
32.03	Explain the fundamentals of cloud services and applications.
33.0	Demonstrate the fundamentals TCP/IP, OSI and Internet models of network layer addressing. – The student will be able to:
33.01	Explain the fundamentals of the OSI and Internet models.
33.02	Explain and understand IPv4 classic addressing schemes and IPv6.
33.03	Explain the purpose of common TCP and UDP ports, protocols.
33.04	Explain the fundamentals of desktop-mobile use of TCP/IP configurations.
34.0	Setup and configure basic VoIP telephony functionality for business users. – The student will be able to:
34.01	Explain the fundamentals of telephony and transition of that technology to VoIP.
34.02	List and describe the major components of user setup, basic configuration using VoIP.
34.03	Successfully configure a basic VoIP user, test the circuit for functionality.
35.0	Setup and configure VPN on desktop, tablet, and laptop platforms. – The student will be able to:
35.01	Explain and compare the different technology and security used by VPN in the enterprise.
35.02	Configure and test a VPN client on a desktop, tablet or laptop.
35.03	Configure and test a public cloud-based VPN system.
36.0	Demonstrate proficiency installing, configuring, and troubleshooting management system agents, anti-virus, group policy objects, operating systems and applications updates. – The student will be able to:
36.01	Explain the purpose enterprise management systems, both local and cloud-based.
36.02	Explain enterprise anti-malware systems and the agents critical to their success.
36.03	Explain the purpose of domain GPOs in the overall strategy for policy and security of the network.
36.04	Explain the control of application and operating system updates.
36.05	Demonstrate installing configuring and troubleshooting management agents, anti-malware, GPOs, and updates.
37.0	Demonstrate proficiency in installing, configuring and troubleshooting client-side virtualization. – The student will be able to:
37.01	Identify hardware and software requirements for client-side virtualization.
37.02	Install type 1 and type 2 hypervisors on desktop operating systems.
37.03	Install, configure, and troubleshoot guest operating systems.



38.0	Demonstrate proficiency with different operating systems. – The student will be able to:
38.01	Compare and contrast Windows, Linux and the MAC OS.
38.02	Explain the use and purpose of different operating systems within an enterprise.
38.03	Identify the certifications and skills needed to support different operating systems.
38.04	Compare the technical support challenges of different operating systems within a company.
39.0	Demonstrate proficiency of user data backup, configuration, and recovery. – The student will be able to:
39.01	Explain the fundamentals of user profiles and user data redirection.
39.02	Properly migrate a user's data and settings from one platform to another.
39.03	Troubleshoot user profiles issues.
39.04	Demonstrate user data recovery and backup.
40.0	Demonstrate troubleshooting of PC and laptop hardware failures. – The student will be able to:
40.01	Troubleshoot a variety of hardware failures.
40.02	Troubleshoot hard drive, RAID issues, cable connections, adapter, overheating, and power supply and motherboard and monitor.
41.0	Demonstrate troubleshooting of PC-laptop boot failures, BSOD, shutdown, devices failing to start, missing DLL message. – The student will be able to:
41.01	Troubleshoot a variety of boot and shutdown failures.
41.02	Troubleshoot BSOD, operating system errors message, device and services failing to start, missing DLLs.

**Course Number: CTS0020**  
**Occupational Completion Point: D**  
**Networking Fundamentals– 150 Hours – SOC Code 15-1152**

42.0 Describe the operation of data networks. – The student will be able to:

42.01 Explain the function of common networking protocols.

42.02 Identify commonly used TCP and UDP default ports.

42.03 Identify address formats- IPv4, IPv6, MAC address.

42.04 Explain the function of each layer of the OSI model.

42.05 Identify the proper use of addressing technologies and addressing schemes.

42.06 Identify common routing protocols.

42.07 Explain the purpose and properties of routing.

42.08 Compare the characteristics of wireless communication standards.

42.09 Interpret network diagrams.

43.0 Differentiate between various network media and topologies. – The student will be able to:

43.01 Categorize standard cable types and their properties.

43.02 Identify common connector types.

43.03 Identify common physical network topologies.

43.04 Differentiate and implement appropriate wiring standards.

43.05 Select the appropriate media, cables, ports, and connectors to connect network devices.

43.06 Categorize WAN technology types and properties.

43.07 Categorize LAN technology types and properties.

43.08 Explain common logical network topologies and their characteristics.

43.09 Install components of wiring distribution.

43.10 Build appropriate cables.

43.11	Troubleshoot common network cabling issues.
44.0	Identify, install, and configure basic network devices. – The student will be able to:
44.01	Install, configure and differentiate between common network devices.
44.02	Identify the functions of specialized network devices.
44.03	Explain the advanced features of a switch.
44.04	Implement a small switched network.
44.05	Verify network status and operation using basic utilities.
45.0	Implement an IP addressing scheme to meet network requirements. – The student will be able to:
45.01	Assign and verify valid IP addresses in a LAN environment.
45.02	Describe Network Address Translation (NAT) and its importance in network communication.
45.03	Distinguish between public and private IP addresses.
45.04	Configure, verify, and troubleshoot DHCP and DNS operation.
45.05	Implement static and dynamic IP addressing.
45.06	Troubleshoot IP addressing issues.
46.0	Demonstrate use of network management tasks and methodologies. – The student will be able to:
46.01	Explain network segmentation and traffic management concepts.
46.02	Conduct network monitoring to identify performance and connectivity issues.
46.03	Implement network troubleshooting methodologies.
46.04	Troubleshoot common connectivity issues and select an appropriate solution.
47.0	Demonstrate proficiency using basic network tools. – The student will be able to:
47.01	Select the appropriate command line interface tool and interpret the output to verify functionality.
47.02	Explain the purpose of network scanners.
47.03	Utilize the appropriate hardware tools.

48.0 Demonstrate an understanding of network security threats and mitigation techniques. – The student will be able to:

48.01 Explain the function of hardware and software security devices.

48.02 Explain common features of a firewall.

48.03 Explain the methods of network access security.

48.04 Explain methods of user authentication.

48.05 Explain issues that affect device security.

48.06 Implement password and physical security in a small routed network.

48.07 Identify common security threats and mitigation techniques.

**Course Number: CTS0026**  
**Occupational Completion Point: D**  
**Network Technician – 150 Hours – SOC Code 15-1152**

49.0 Configure, verify and troubleshoot a switch with VLANs and interswitch communications. – The student will be able to:

49.01 Select the appropriate media, cables, ports, and connectors to connect switches to other network devices and hosts.

49.02 Explain the technology and media access control method for Ethernet networks.

49.03 Explain basic switching concepts and the operation of managed switches.

49.04 Perform and verify switch configuration tasks.

49.05 Verify network status and switch operation using basic utilities.

49.06 Describe enhanced switching technologies.

49.07 Describe how VLANs create logically separate networks and the need for routing between them.

49.08 Configure, verify and troubleshoot VLANs.

49.09 Implement basic switch security.

50.0 Implement an IP addressing scheme and IP Services to meet network requirements in a medium-size Enterprise branch office network. – The student will be able to:

50.01 Describe the operation and benefits of using private and public IP addressing.

50.02 Explain the operation and benefits of using DHCP and DNS.

50.03 Implement static and dynamic addressing services for hosts in a LAN environment.

50.04 Calculate and apply an addressing scheme including subnetting IP networks.

50.05 Describe the technological requirements for running IPv6 in conjunction with IPv4 (e.g., protocols, dual stack, tunneling).

50.06 Describe IPv6 addressing.

50.07 Implement IPv6 in a network environment.

50.08 Identify and correct common problems associated with IP addressing and host configurations.

51.0 Understand basic router operation. – The student will be able to:

51.01	Describe basic routing concepts (e.g., packet forwarding, router lookup process).
51.02	Describe the operation of routers.
51.03	Select the appropriate media, cables, ports and connectors to connect routers to other network devices and hosts.
51.04	Verify network connectivity (using ping, traceroute, telnet or SSH).
51.05	Explain the basics of routing concepts and protocols.
51.06	Explain the basics of Network Address Translation and Port Address Translation.
52.0	Demonstrate proficiency with configuring and Troubleshooting a WLAN. – The student will be able to:
52.01	Describe the standards associated with wireless media.
52.02	Identify and describe the purpose of the components of a small WLAN.
52.03	Configure a small WLAN such that devices connect to the correct access point.
52.04	Describe the security features and capabilities of WI-FI Protected Access (WPA).
52.05	Describe common issues with implementing a WLAN and methods for addressing these issues.
52.06	Describe the wireless security standards.
52.07	Implement the appropriate wireless security standard.
52.08	Design and implement a wireless network using appropriate standards.
52.09	Identify common issues with implementing wireless networks.
52.10	Troubleshoot common wireless network issues.
53.0	Demonstrate proficiency with configuring and Troubleshooting a Server. – The student will be able to:
53.01	Install Server OS and select appropriate roles.
53.02	Configure different server roles (DHCP, DNS, Print Server, File Server).
53.03	Configure network authorization and authentication on server.
53.04	Configure web content filtering and caching (Proxy).

53.05	Install and apply patches and updates.
53.06	Perform network backups and select appropriate mediums.
53.07	Perform software deployment over the network.
54.0	Demonstrate proficiency with configuring and troubleshooting a VPN. – The student will be able to:
54.01	Describe the common protocols and ports associated with a VPN.
54.02	Setup and configure a VPN.
54.03	Troubleshoot common issues associated with VPN connectivity.
55.0	Demonstrate proficiency with configuring and troubleshooting a VOIP. - The student will be able to:
55.01	Explain Quality of Service and how it applies to a VOIP system.
55.02	Describe common protocols associated with VOIP.
55.03	Explain the main features of a Call Management System.
56.0	Demonstrate proficiency with configuring and troubleshooting Virtualization. – The student will be able to:
56.01	Setup and configure a networked virtual environment (e.g. Server Farm).
56.02	Explain the positives and negatives of virtualization.
56.03	Explain the different types of Storage Area Network devices.
56.04	Explain Cloud computing and cloud storage.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered. The activities of such organizations are defined as part of the curriculum in accordance with Rule 6A-6.065, F.A.C.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.



## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Digital Media Technology  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y500100
CIP Number	0509070200
Grade Level	30, 31
Standard Length	750 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1142 – Network and Computer Systems Administrators
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in technical digital media positions in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills.

The content includes but is not limited to practical experiences in the implementation, management, and maintenance of advanced telecommunication environments associated with the creation, packaging, and delivery of digital media.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of two occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	DIG0080	Digital Media Technician	BUS ED 1 @2 DIGI MEDIA 7G INFO TECH 7G	600 hours	15-1142

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Describe characteristics of digital media relative to format, standards, encoding schemes, and origin.
- 16.0 Compare and contrast various forms of digital media delivery systems.
- 17.0 Demonstrate an understanding of handling equipment, recording video and audio, exporting files and editing projects.
- 18.0 Demonstrate an understanding of the characteristics, development medium, and technical aspects of digital audio.
- 19.0 Create animation in digital media that enhances production.
- 20.0 Perform safety skills while performing or recording on set.
- 21.0 Apply appropriate lighting for location and/or set productions.
- 22.0 Operate a video camera.
- 23.0 Record, mix and edit audio resources.
- 24.0 Shoot Studio and /or location footage.
- 25.0 Design and generate graphic elements.
- 26.0 Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital video.
- 27.0 Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital audio.
- 28.0 Apply industry standard workflow management methods applicable to the integration and synchronization of audio and video into a single digital media product.
- 29.0 Apply industry standard asset management methods applicable to development of a digital media product.
- 30.0 Explain the importance of calibration in the production of digital media and the means by which it is accomplished.
- 31.0 Demonstrate proficiency in producing a digital media product for delivery for both televised and online streaming media.

- 32.0 Demonstrate proficiency in producing a digital media product for delivery using an Internet-based on-demand system (e.g., VOD, IPTV).
- 33.0 Demonstrate proficiency in producing a digital media product for delivery using an Internet-based streaming system.
- 34.0 Demonstrate proficiency in producing a digital media product for delivery using an Internet-based system featuring multi-point presence.
- 35.0 Demonstrate proficiency in producing a digital media product for delivery using satellite delivery systems.
- 36.0 Describe the evolution, role, and characteristics of a Content Distribution Network (CDN) for delivering digital media to Internet points.
- 37.0 Demonstrate an understanding of Internet Protocol Television (IPTV) systems, their types, applications, and implementation issues.
- 38.0 Successfully plan out and produce a professional portfolio showcasing mastery of multimedia production and self-marketing.
- 39.0 Utilize best practices involving advanced professional grade equipment.
- 40.0 Use innovative means and perceptual understanding to communicate through varied content, media and digital art techniques.
- 41.0 Develop competence and dexterity, through the use of processes, tools and techniques for various media.
- 42.0 Examine career opportunities in the Digital Media Field to determine requisite skills, qualifications, supply-and-demand, market location and potential earnings.
- 43.0 Demonstrate professional organizational skills to influence sequential process when producing multimedia.
- 44.0 Demonstrate professional interview skills.

Florida Department of Education  
Student Performance Standards

Program Title: Digital Media Technology  
Career Certificate Program Number: Y500100

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

**Course Number: DIG0080**  
**Occupational Completion Point: B**  
**Digital Media Technician – 600 Hours – SOC Code 15-1142**

15.0	Describe characteristics of digital media relative to format, standards, encoding schemes, and origin. – The student will be able to:
15.01	Determine the meaning of symbols, key terms, and other domain-specific words and phrases.
15.02	Identify and differentiate the appropriate use of digital media formats based on standard industry practices.
15.03	Identify and differentiate the appropriate use of encoding schemes based on project needs.
15.04	Identify the difference between digital media source files and digital media delivery systems.
16.0	Compare and contrast various forms of digital media delivery systems. – The student will be able to:
16.01	Identify the differences between fixed digital media formats and digital media streaming.
16.02	Identify the various forms of digital media content distribution.
16.03	Describe the development of digital media technology as it pertains to digital signage.
16.04	Describe the impact of mobile and Wi-Fi technologies on the digital media development industry.
17.0	Demonstrate an understanding of handling equipment, recording video and audio, exporting files and editing projects. – The student will be able to:
17.01	Identify digital image file types and their appropriate uses.
17.02	Compare and contrast the similarities and differences between Standard Definition and High Definition recordings.
17.03	Describe and apply the characteristics of digital video.
17.04	Identify and describe the various application platforms used in digital video development.
17.05	Create a video production that meets the industry standards of production.
18.0	Demonstrate an understanding of the characteristics, development medium, and technical aspects of digital audio. – The student will be able to:
18.01	Identify and describe the fundamental aspects of sound theory.
18.02	Compare and contrast the similarities and differences between various audio recordings.
18.03	Describe the characteristics of digital audio.
18.04	Identify and describe the various application platforms used in digital audio recording and editing.
18.01	Enhance storytelling using sound effects.
18.02	Capture and edit original audio to be utilized with in class video production projects.



19.0	Create animation in digital media that enhances production. – The student will be able to:
19.01	Describe the process of developing animations and identify the industry standard platforms used in their creation.
19.02	Describe the similarities and differences as well as industry standard platforms used in the development of 2D and 3D graphics.
19.03	Identify and describe the challenges in developing and deploying digital media content.
19.04	Identify the components and characteristics of motion that make up an animation.
19.05	Create animations within production.
19.06	Produce storyboarding, production plans (GANTT CHARTS) and playable rough cuts.
20.0	Perform safety skills while performing or recording on set. – The student will be able to:
20.01	Perform proper care of equipment.
20.02	Demonstrate appropriate use of equipment in an efficient manner.
20.03	Demonstrate awareness of appropriate ergonomics.
20.04	Demonstrate safe ways to create action on set.
20.05	Apply ethical practices.
21.0	Apply appropriate lighting for location and/or set productions--The student will be able to:
21.01	Determine appropriate lighting needs for production settings.
21.02	Identify locations and studio lighting types, method of use and application.
21.03	Use lighting equipment according to industry safety standards.
22.0	Operate a video camera. – The student will be able to:
22.01	Use current industry standard production video equipment.
22.02	Operate camera in studio and location (field) production environments.
22.03	Align camera for studio production.
22.04	Demonstrate appropriate framing for both SDTV and HDTV.
22.05	Operate (CCU) Camera Control Uni.
23.0	Record, mix and edit audio resources. – The student will be able to:

23.01	Identify and select microphones for production needs.
23.02	Determine optimal microphone placement.
23.03	Establish appropriate recording conditions.
23.04	Set up audio recording equipment.
23.05	Perform appropriate pre-production check of production equipment.
23.06	Record location sound.
23.07	Record studio live sound.
23.08	Perform basic routine, preventative and repair maintenance on video equipment.
23.09	Define the various recording formats and media.
23.10	Define appropriate digital compression and signal (file) types.
23.11	Perform sound edits and enhancements.
24.0	Shoot studio and/or location footage. – The student will be able to:
24.01	Plan a shot to obtain required action/footage.
24.02	Demonstrate appropriate shot sequences, transitions and post production (edit) effects.
24.03	Control camera movement to obtain required effects.
24.04	Control lens, focal length, aperture and exposure to obtain required effects.
24.05	Set up camera and recording equipment sequence.
25.0	Design and generate graphic elements. – The student will be able to:
25.01	Determine the graphic requirements for a production.
25.02	Operate graphic production software.
25.03	Produce broadcast graphic elements for titling, credits and graphic transitions.
25.04	Determine the special effects need for a production.

25.05	Set up and operate character generator equipment and software.
25.06	Generate appropriate special effects and animated elements for a production.
25.07	Demonstrate an understanding of graphic image types, file formats, and technical requirements for a production.
25.08	Use image editing (bit mapped) software.
25.09	Edit graphics into the program or segment.
25.10	Demonstrate an ability to use type, color, composition and graphic elements for a specific production effect.
25.11	Demonstrate an ability to use different aspect ratios as needed for SDTV and HDTV.
25.12	Identify and describe the standard practices for retrieving digital media assets both on local and remote work stations / networks.
25.13	Describe the standard practices for establishing digital asset security.
25.14	Describe the purpose and function of metadata as it pertains to the management of digital assets.
26.0	Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital video. – The student will be able to:
26.01	Produce video files according to industry standard specifications using digital media development hardware and software applications.
26.02	Identify and incorporate the appropriate use of digital video encoding based on industry standard practices.
26.03	Identify the various tools and procedures utilized in the conversion of digital media file types.
26.04	Demonstrate proficiency in the utilization of standard video production equipment.
26.05	Demonstrate proficiency in the connectivity and configuration of digital video equipment.
26.06	Identify and troubleshoot lighting issues as they pertain to the recording of digital video as well as describe common industry practices in the staging of light sources.
27.0	Demonstrate proficiency configuring and operating equipment and software applications used in the creation and delivery of digital audio. – The student will be able to:
27.01	Produce audio files according to industry standard specifications using digital media development hardware and software applications.
27.02	Demonstrate proficiency in the utilization of standard audio production equipment.
27.03	Demonstrate proficiency in the connectivity and configuration of digital audio equipment.
28.0	Apply industry standard workflow management methods applicable to the integration and synchronization of audio and video into a single digital media product. – The student will be able to:

28.01	Describe the various media integration systems and their appropriate uses in the development of digital media.
28.02	Identify and describe the importance of version control in digital asset management.
28.03	Identify and describe the various forms of digital audio / video synchronization and the tools and techniques used to sync digital audio and video.
28.04	Successfully operate digital audio/video devices simultaneously in order to produce HD quality media to synchronize assets for post-production.
29.0	Apply industry standard asset management methods applicable to development of a digital media product. – The student will be able to:
29.01	Identify and describe the standard practices for storing and archiving digital media assets.
29.02	Successfully apply and enhance upon industry standard practices for storing and archiving digital media assets.
29.03	Identify and describe the standard practices for retrieving digital media assets both on local and remote work stations / networks.
29.04	Describe the standard practices for establishing digital asset security.
29.05	Describe the purpose and function of metadata as it pertains to the management of digital assets.
30.0	Explain the importance of calibration in the production of digital media and the means by which it is accomplished. – The student will be able to:
30.01	Identify the necessity and effects of calibration on various digital media systems.
30.02	Identify standard practices in calibrating digital media production equipment.
12.01	Use lighting for effect to control mood and impact in production settings.
12.02	Use studio lighting master control equipment.
31.0	Demonstrate proficiency in producing a digital media product for delivery for both televised and online streaming media. – The student will be able to:
31.01	Identify and describe the various physical and application formats for (DVD) media technology.
31.02	Identify and describe the various (DVD) physical outputs for media players.
31.03	Identify the features and specifications of (DVD) media and the (DVD) format.
31.04	Identify and describe the (DVD) media industry specification (red book standard).
31.05	Identify and describe the various coding mechanisms utilized in the creation of (DVD) media.
31.06	Identify and describe standard copy protection practices in (DVD) media creation.

31.07	Use standard (DVD) authoring / editing systems in the creation of (DVD) media.
31.08	Identify and describe the appropriate use of standard television formats (PAL & NTSC).
31.09	Demonstrate an awareness of the issues in quality when compressing digital media.
32.0	Demonstrate proficiency in producing a digital media product for delivery using an Internet-based on-demand system (e.g., VOD, IPTV). – The student will be able to:
32.01	Develop digital media in the appropriate specified format for delivery on On-Demand Systems.
32.02	Develop digital media in the appropriate specified format for delivery on Video on demand (VOD) Systems.
32.03	Develop digital media in the appropriate specified format for delivery on IP Television (IPTV).
33.0	Demonstrate proficiency in producing a digital media product for delivery using an Internet-based streaming system. – The student will be able to:
33.01	Develop digital media in the appropriate specified format for delivery on On-Demand Systems.
33.02	Develop digital media in the appropriate specified format for delivery on Video on demand (VOD) Systems.
33.03	Develop digital media in the appropriate specified format for delivery on IP Television (IPTV).
33.04	Develop digital media in the appropriate specified format for delivery on Grid Casting systems.
34.0	Demonstrate proficiency in producing a digital media product for delivery using an Internet-based system featuring multi-point presence. – The student will be able to:
34.01	Demonstrate an awareness of the tools and practices used in establishing multiple points of presence.
34.02	Demonstrate an awareness of design constraints and attributes as they pertain to producing digital media for delivery on internet-based systems.
34.03	Demonstrate an awareness of communication channels and considerations as they pertain to producing digital media for delivery on internet-based systems.
35.0	Demonstrate proficiency in producing a digital media product for delivery using satellite delivery systems. – The student will be able to:
35.01	Identify industry applications utilized in producing a digital media product for delivery using satellite delivery systems.
35.02	Identify current technologies and capabilities used in the production of a digital media product for delivery using satellite delivery systems.
35.03	Describe the current limitations (e.g. latency) of delivering digital media via satellite delivery systems.
35.04	Identify and describe common issues in delivering digital media via simulcast systems.
35.05	Identify and describe the process of delivering digital media via multicast systems.

36.0	Describe the evolution, role, and characteristics of a Content Distribution Network (CDN) for delivering digital media to Internet points. – The student will be able to:
36.01	Describe content networking techniques as they pertain to the delivering of digital media to internet points.
37.0	Demonstrate an understanding of Internet Protocol Television (IPTV) systems, their types, applications, and implementation issues. – The student will be able to:
37.01	Demonstrate an understanding of converged services and their application to Internet Protocol Television (IPTV).
37.02	Compare and contrast live versus stored media systems.
37.03	Demonstrate an understanding of Internet Protocol Television (IPTV) applications and delivery systems.
37.04	Demonstrate an understanding of common issues that pertain to the development of digital media for distribution over Internet Protocol Television (IPTV) systems.
38.0	Successfully plan out and produce a professional portfolio showcasing mastery of multimedia production and self-marketing.– The student will be able to:
38.01	Showcase a high level of creative independence in producing multimedia content that focuses on the individual student's strengths and build upon any skills that may require additional practice throughout the Portfolio development.
38.02	Student will both document and demonstrate both successful and unsuccessful progress a throughout their portfolio development by use of a Production Schedule or GANTT CHART.
38.03	Write, direct and produce an amateur short film. This work will be continuously progressive until a Portfolio deadline is designated.
38.04	Write, direct and produce an amateur commercial advertisement. This work will be continuously progressive until Portfolio deadline is designated.
38.05	Write, direct and produce an amateur Visual Postcard. This work will be continuously progressive until Portfolio deadline is designated
38.06	Write, direct and produce an amateur Motion Graphics based tutorial. This work will be continuously progressive until Portfolio deadline is designated
39.0	Utilize best practices involving advanced professional grade equipment. – The student will be able to:
39.01	Pack and transport equipment.
39.02	Identify and dismantle/assemble equipment.
39.03	Locate, scout and obtain appropriate on site permission.
39.04	Use model release form documents.
39.05	Scout locations for proper electrical outlets.
39.06	Plan, coordinate and manage a production GANTT Chart
39.07	Define specific dates for multiple video production projects.
39.08	Determine post-production requirements.

39.09	Coordinate post-production values.
39.10	Identify and attempt to resolve production issues during post-production.
39.11	Practice leadership skills.
39.12	Manage crew and staff during pre-planning and production.
39.13	Present project proposals including script, storyboards and shot lists.
39.14	Delegate and assign tasks to members during all phases of production.
39.15	Examine career opportunities in the Digital Media field to determine requisite skills, qualifications, supply-and-demand, market location, and potential earning.
39.16	Apply advanced color correction techniques to film.
39.17	Demonstrate and apply primary practice of marketing sales techniques.
40.0	Use innovative means and perceptual understanding to communicate through varied content, media and digital art techniques. – The student will be able to:
40.01	Showcase a high level of creative independence in producing multimedia content that focuses on the individual student's strengths and build upon any skills that may require additional practice throughout Portfolio development.
40.02	Students will both document and demonstrate both successful and unsuccessful progress throughout their portfolio development by use of a Production Schedule or GANNT CHART.
40.03	Write, direct and produce an amateur short film. This work will be continuously progressive until a Portfolio deadline is designated.
40.04	Write, direct and produce an amateur commercial advertisement. This work will be continuously progressive until Portfolio deadline is designated.
40.05	Write, direct and produce an amateur Visual Postcard. This work will be continuously progressive until Portfolio deadline is designated.
40.06	Write, direct and produce an amateur Motion Graphics based tutorial. This work will be continuously progressive until Portfolio deadline is designated.
40.07	Demonstrate strong use of graphical design programs (Photoshop, Illustrator) to edit, enhance and properly choose formats for placement and use in Premiere, Final Cut, Motion or After Effects.
41.0	Develop competence and dexterity, through practice, in the use of processes, tools and techniques for various media. – The student will be able to:
41.01	Utilize best practices involving advanced professional grade equipment.
41.02	Pack and transport equipment.
41.03	Identify and dismantle/assemble equipment.
41.04	Use model release form documents.
41.05	Locate, scout and obtain appropriate on site permission as needed.

41.06	Define specific dates for multiple video production projects.
41.07	Coordinate post-production values.
41.08	Identify and attempt to resolve production issues during post-production.
41.09	Present project proposals including script, storyboards and shot lists.
41.10	Delegate and assign tasks to members during all phases of production.
41.11	Manage crew and staff during pre-planning and production.
42.0	Examine career opportunities in the Digital Media field to determine requisite skills, qualifications, supply-and-demand, market location, and potential earning. – The student will be able to:
42.01	Demonstrate and apply primary practice of marketing sales techniques.
42.02	Identify, demonstrate and practice modern day online and televised marketing techniques.
42.03	Research average salary range for various Digital Media careers.
42.04	Research existing Digital Media careers and determine specified skills and qualifications.
43.0	Demonstrate professional organizational skills to influence sequential process when producing multimedia. – The student will be able to:
43.01	Properly save and export multiple formats of video, audio and images from specified editing programs for use in cross platform devices and software.
43.02	Use PC/MAC operating system to create multiple directories specified to the types of media being imported or used for their projects.
43.03	Identify known software issues and determine solutions.
43.04	Understand updated software and its system requirements.
44.0	Demonstrate professional interview skills. – The student will be able to:
44.01	Showcase the value of their own skills during mock interviews.
44.02	Be able to present works to others and openly discuss the purpose of its value.
44.03	Initiate and participate in group discussions related to others progress and offer intuitive solutions as well as accepting constructive criticism and conforming to new processes.

#### **Additional Information**

#### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations



benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

### **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as

instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Modeling Simulation Production  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y500200
CIP Number	0511080402
Grade Level	30, 31
Standard Length	1500 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 15-1132 – Software Developers, Applications 15-1131– Computer Programmer
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

**Purpose**

The Modeling and Simulation program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster and the expansive employment opportunities in the field of Modeling and Simulation. This course provides technical skill proficiency and includes competency-based applied learning through the use of hands-on labs and the development of a multi-year portfolio. Students will build academic knowledge, enhance higher-order reasoning and problem-solving skills, develop leadership and collaboration abilities and refine general employability and occupation-specific skills.

The content includes but is not limited to practical experiences in modeling and simulation conceptualization, design, storyboarding, development methodologies, essential programming techniques, prototype development, production processes and implementation challenges. Science, Computer Programming and Math are embedded throughout the program to emphasize the relationship between these areas and the field of Modeling and Simulation. To further enrich this course sequence it is recommended students take a sequence of electives in either visual arts,

computer arts, or digital arts including but not limited to Computer Programming, Web Design, Gaming and Animation, Robotics and/or Geospatial/Geographic Information Systems Technology.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of six occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0770	Modeling & Simulation Technician	COMPU SCI 6	150 hours	15-1199
B	CTS0776	Modeling & Simulation Programmer I	ENG&TEC ED1@2	300 hours	15-1131
C	CTS0777	Modeling & Simulation Programmer II	TEC ED 1 @2	300 hours	15-1131
D	CTS0779	Modeling & Simulation Advanced Programmer	ENG 7G	300 hours	15-1131
E	CTS0774	Modeling & Simulation Developer	ENG TECH 7G INFO TECH 7G COMP PROG 7G ROBOTICS 7G BUS ED 1 @2 TV PRO TEC @7 7G COMM ART @ 7 7G	450 hours	15-1132

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## **Standards**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge.
- 02.0 Demonstrate information fluency using emerging research techniques and technology.
- 03.0 Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation.
- 04.0 Explain intelligent systems as they relate to modeling, simulation and data analysis.
- 05.0 Demonstrate knowledge of different operating systems
- 06.0 Explore software evolution and lifecycle as it relates to modeling and simulation.
- 07.0 Understand the production process of modeling, simulation and entertainment.
- 08.0 Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets.
- 09.0 Demonstrate production use of high-end Game Engines.
- 10.0 Categorize the different gaming genres.
- 11.0 Describe the game development life cycle.
- 12.0 Develop a game design document.
- 13.0 Identify gameplay elements and their characteristics.
- 14.0 Explore the methods used to create and sustain player immersion.
- 15.0 Describe the general principles of storytelling.
- 16.0 Develop an understanding of programming languages as they relate to modeling and simulation.
- 17.0 Incorporate audio assets into modeling and simulation engine.
- 18.0 Implement multimedia programming as it relates to modeling simulation using a gaming engine.
- 19.0 Create and maintain documentation.
- 20.0 Compile, build and publish finished games and simulation.
- 21.0 Analyze, identify and use game engine physics.
- 22.0 Develop effective user interfaces (UI).
- 23.0 Use real time technology to model and simulate environments.
- 24.0 Demonstrate an understanding of underlying principles of numerical analysis and how it relates to modeling and simulation.
- 25.0 Plan program design using object oriented programming (OOP) for modeling and simulation.
- 26.0 Use programming to develop modeling and simulation applications.
- 27.0 Test programs related to modeling and simulation.
- 28.0 Explain visual simulation.
- 29.0 Analyze model fidelity as related to modeling and simulation techniques.
- 30.0 Demonstrate knowledge of rigging.
- 31.0 Demonstrate knowledge of basic character setup.
- 32.0 Demonstrate knowledge of motion capture systems.
- 33.0 Understand systems engineering for simulators.
- 34.0 Analyze numerical characteristics of univariate data sets to describe patterns and departure from patterns, using statistics for various distributions.

- 35.0 Perform program maintenance to troubleshoot and optimize code.
- 36.0 Use innovative technologies to create prototypes of models.
- 37.0 Develop and program complex artificial intelligence systems (AI).
- 38.0 Identify functions of advance memory and information processing.
- 39.0 Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices.
- 40.0 Build a simple scenario for experimentation or training.
- 41.0 Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation.
- 42.0 Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error.
- 43.0 Use innovative technologies to create prototypes of models.
- 44.0 Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production.
- 45.0 Demonstrate information fluency using emerging research techniques and technology.

Florida Department of Education  
Student Performance Standards

Program Title: Modeling Simulation Production  
Career Certificate Program Number: Y500200

<b>Course Number: CTS0770</b>	
<b>Occupational Completion Point: OCP A</b>	
<b>Modeling &amp; Simulation Technician – 150 Hours – SOC Code 15-1199</b>	
01.0	Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge. – The student will be able to:
01.01	Define and explain essential modeling and simulation terms and concepts.
01.02	Identify disciplines which use modeling and simulation tools and discuss their real world applications.
01.03	Identify modeling and simulation related careers and the educational and professional requirements for various fields.
01.04	Compare and contrast the central modeling and simulation concepts and careers.
01.05	Explain the past, present, and future importance of modeling and simulation.
02.0	Demonstrate information fluency using emerging research techniques and technology. – The student will be able to:
02.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer.).
02.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
02.03	Use technology tools to collaborate and generate a deliverable product.
02.04	Develop and display an electronic portfolio.
02.05	Demonstrate research skills using browsers, search engines, directories, and databases.
02.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
02.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
02.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
02.09	Identify effective Boolean search strategies.



02.10	Correlate the use of social media in the field of modeling and simulation for a variety of purposes.
02.11	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).
03.0	Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation. – The student will be able to:
03.01	Explain how information technology and modeling and simulation impact the operation and management of business and society.
03.02	Explain the emergence of e-commerce and e-government and the potential impact on business and society.
03.03	Trace the evolution of the Internet from its inception to the present and into the future.
03.04	Analyze physical models and organize them conceptually based on their development and historical relevance.
03.05	Use graphic technology to create a visualization of a historic simulator or synthetic environment that has evolved over time.
03.06	Describe the evolution of the digital computer as it relates to modeling and simulation.
03.07	Explain the need for and use of input devices and displays to design and create models and simulations.
03.08	Demonstrate an understanding of storage management (e.g., hard drive, floppy disk) as it relates to creating and storing digital models and simulations.
03.09	Identify the advantages and limitations of computer-generated models and simulation.
04.0	Explain intelligent systems as they relate to modeling, simulation and data analysis. – The student will be able to:
04.01	Define intelligent system.
04.02	Explain and examine structured logic and semantics.
04.03	Explain the use of intelligent systems.
04.04	Examine programs using the elements of an intelligent system.
05.0	Demonstrate knowledge of different operating systems. – The student will be able to:
05.01	Explain the history and purpose of various operating systems (e.g., DOS, Windows, Mac, and Unix/Linux).
05.02	Discuss the impact of RAM and ROM technology on the development of the modern computer operating systems and microcomputers.
05.03	Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).
05.04	Identify the internal components of a computer (e.g., power supply, hard drive, motherboard, input/output (I/O) cards/ports, cabling).
05.05	Identify the different control systems for simulation.
05.06	Explain the factors that can limit the simulation capabilities of personal computers.

06.0	Explore software evolution and lifecycle as it relates to modeling and simulation. – The student will be able to:
06.01	Explain software and hardware lifecycles and their steps.
06.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.0	Understand the production process of modeling, simulation and entertainment. – The student will be able to:
07.01	Explain software and hardware lifecycles and their steps.
07.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.03	Demonstrate speed and efficiency concepts.
07.04	Demonstrate use of a production pipeline.
07.05	Identify the departments of an animation studio
07.06	Describe the interrelationships among departments.
07.07	Demonstrate basic communication concepts (verbal, memos, paperwork).
07.08	Identify the stages of production.
07.09	Correctly use studio terms and jargon.
07.10	Create and organize production paperwork into design/production documentation.
07.11	Identify target audiences, markets, and demographics.
07.12	Demonstrate ability to write a professionally formatted script.
07.13	Demonstrate ability to breakdown a script into production elements (cast, props).
07.14	Demonstrate understanding of visual storytelling and how storyboards are used during production.
08.0	Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets. – The student will be able to:
08.01	Practice ethical behaviors regarding copyright, citation, and plagiarism.
08.02	Understand the process of patent application filing, product trials, and communication techniques to describe their product.
08.03	Explain the purposes of copyrights, trademarks, and patents and understand the limitations and expectations.
08.04	Explore and examine components of intellectual property such as patents, copyrights, trademarks, and trade secrets.

08.05	Understand “Fair Use and Fair Dealing” practices.
08.06	Understand the transfer and licensing of creative works.
08.07	Understand the use of “exclusive rights” to intellectual creations.
08.08	Utilize digital watermarking.
09.0	Demonstrate production use of high-end Game Engines. – The student will be able to:
09.01	Demonstrate working knowledge of interface and workspace.
09.02	Setup projects properly.
09.03	Create and transform game objects and edit their properties.
09.04	Create and use collision models and triggers.
09.05	Setup and modify camera.
09.06	Apply input data into game systems.
09.07	Implement animation setup.
09.08	Create and modify particle systems and their properties.
09.09	Design and implement visual effects using compositing techniques.
09.10	Develop, test and implement game scripts.
10.0	Categorize the different gaming genres. – The student will be able to:
10.01	Research, compare and categorize different game genres.
10.02	Analyze examples of different gaming genres.
10.03	Define and use the necessary vocabulary related to gaming and the different game genres.
11.0	Describe the game development life cycle. – The student will be able to:
11.01	Identify steps in the pre-production process including the proof of concept and market research.
11.02	Describe the iterative prototyping process (e.g., Alpha, Beta).
11.03	Determine platform, technology and scripting requirements.

11.04	Implement techniques of scenario development, levels, and missions.
11.05	Discuss game testing requirements and methods.
12.0	Develop a game design document. – The student will be able to:
12.01	Evaluate and discuss the choice of delivery system.
12.02	Evaluate and discuss choices of genre, game design software, art, digital media, and animation software.
12.03	Create a game strategy overview, character overview, and storyboard overview.
12.04	Define the rules of play and multi-player options.
12.05	Create the layout and interfaces overview and digital media overview.
12.06	Determine the gameplay interaction requirements and create the progression levels overview.
12.07	Define strategic positioning of game immersion dynamics and psychological effect.
12.08	Identify hardware and software constraints.
13.0	Identify gameplay elements and their characteristics. – The student will be able to:
13.01	Analyze and deconstruct game environments and interactions.
13.02	Compare and contrast popular games and simulations in terms of player interaction, plot complexity, and rewards.
13.03	Categorize gameplay elements by player types and target audience.
14.0	Explore the methods used to create and sustain player immersion. – The student will be able to:
14.01	Research and define the term “immersion”.
14.02	Explore and explain factors that create player immersion in a game or simulation.
14.03	Examine games and simulations and explain the methods each one uses to increase player immersion.
15.0	Describe the general principles of storytelling. – The student will be able to:
15.01	Identify the essential elements of a story.
15.02	Describe how creative writing is used as a game design tool.
15.03	Compare and contrast methods of delivering a story in a game.

**Course Number: CTS0776**  
**Occupational Completion Point: OCP B**  
**Modeling & Simulation Programmer I – 300 Hours – SOC Code 15-1131**

16.0 Develop an understanding of programming languages as they relate to modeling and simulation. – The student will be able to:

16.01 Explain the history of programming languages.

16.02 Explain how compilers work.

16.03 Identify the three types of programming design approaches (e.g., top-down, structured and object-oriented).

17.0 Incorporate audio assets into modeling and simulation engine. – The student will be able to:

17.01 Describe the audio effects workflow.

17.02 Explain audio codecs and formats used in game/simulation engines.

17.03 Import audio into the game/simulation engine.

17.04 Use appropriate naming conventions for audio assets.

18.0 Implement multimedia programming as it relates to modeling simulation using a gaming engine. – The student will be able to:

18.01 Demonstrate proficiency in creating multiple composite objects.

18.02 Demonstrate proficiency in moving composite graphics objects.

18.03 Demonstrate proficiency in rotating composite graphics objects manually.

18.04 Distinguish between flock and flee artificial intelligence algorithms.

18.05 Write programs that use blitting.

18.06 Identify the basic constructs used in bounding box collision algorithms.

18.07 Identify the basic constructs used in truer bounding box collisions.

18.08 Demonstrate proficiency in creating a bouncing simulation.

18.09 Simulate pattern-based movement.

18.10 Simulate multiple sprites movement.

18.11 Identify the basic constructs used in keyboard input.

18.12 Identify the basic constructs used in mouse input.

18.13 Identify the basic constructs used in double buffering.

19.0	Create and maintain documentation. – The student will be able to:
19.01	Write documentation to assist operators and end-users.
19.02	Follow established documentation standards.
19.03	Update existing documentation to reflect program changes.
20.0	Compile, build and publish finished games and simulation. – The student will be able to:
20.01	Apply proper settings depending on the intended publishing platforms.
20.02	Refine project to increase performance.
20.03	Successfully build a game and simulation.
20.04	Publish product to intended platform.
21.0	Analyze, identify and use game engine physics. – The student will be able to:
21.01	Identify the different components used by the engine’s physics system.
21.02	Apply “ray casting” to solve different physics and collision problems.
21.03	Change physics settings depending on simulation needs.
22.0	Develop effective user interfaces (UI). – The student will be able to:
22.01	Utilize various design techniques for UI development.
22.02	Create clear, concise, responsive UI.
22.03	Provide efficient feedback while interacting with the UI.

**Course Number: CTS0777**  
**Occupational Completion Point: OCP C**  
**Modeling & Simulation Programmer II – 300 Hours – SOC Code 15-1131**

23.0	Use real time technology to model and simulate environments. The student will be able to:
23.01	Identify simulator applications.
23.02	Identify where team simulators would be appropriate.
23.03	Identify where individual simulators would be appropriate.
23.04	Understand where and why networked simulators are used.
24.0	Demonstrate an understanding of underlying principles of numerical analysis and how it relates to modeling and simulation. – The student will be able to:
24.01	Apply logical reasoning skills to solve real-world problems through the development of mathematical models.
24.02	Design a step-by-step plan (algorithm) to solve a given problem.
24.03	Write program specifications that define the constraints of a given problem.
24.04	Use a programmable calculator.
24.05	Write an algorithm to solve mathematical problems using formulas, equations, and functions.
25.0	Plan program design using object oriented programming (OOP) for modeling and simulation. – The student will be able to:
25.01	Formulate a plan to determine program specifications individually or in groups.
25.02	Use a graphical representation or pseudo code to represent the structure in a program or subroutine.
25.03	Design programs to solve problems using problem-solving strategies.
26.0	Use programming to develop modeling and simulation applications. – The student will be able to:
26.01	Utilize reference manuals.
26.02	Write programs according to recognized programming standards.
26.03	Write internal documentation statements as needed in the program source code.
26.04	Code programs in high-level languages for game/simulation applications.
26.05	Write code that accesses sequential, random, and direct files.

26.06	Code programs using logical statements (e.g., If-Then-Else, Do...While).
26.07	Enter and modify source code using a program language editor.
26.08	Code routines within programs that validate input data.
26.09	Use the rounding function in calculations within programs.
26.10	Write programs as part of a development team.
26.11	Write event-driven programs.
26.12	Write programs using timed-event strategies and methodologies.
26.13	Write programs that include score keeping.
26.14	Write programs that display text.
26.15	Write programs that use composite graphic objects.
26.16	Write programs that load a bitmap for background.
26.17	Write programs that utilize a sprite handler.
26.18	Write programs that use animation.
26.19	Write programs that use scrolling.
26.20	Write programs that use transparency.
26.21	Write documentation to assist operators and end-users.
26.22	Follow established documentation standards.
26.23	Update existing documentation to reflect program changes.
27.0	Test programs related to modeling and simulation. – The student will be able to:
27.01	Perform debugging activities.
27.02	Evaluate program test results.
27.03	Use trace routines of compilers to assist in program debugging.



27.04 Compile and run programs.

27.05 Create a stable code base.

27.06 Develop data for use in program testing.

27.07 Distinguish among the different types of program and design errors.

**Course Number: CTS0779**  
**Occupational Completion Point: OCP D**  
**Modeling & Simulation Advanced Programmer – 300 Hours – SOC Code 15-1131**

28.0 Explain visual simulation. – The student will be able to:

28.01 Define and explain uses of visual simulation.

28.02 Explain the use of visual simulation in distributed simulation.

28.03 Explain the functions of the image generators, display and databases to support visual subsystem of simulators.

29.0 Explain distributed simulation. – The student will be able to:

29.01 Explain networking concepts.

29.02 Explain distributed simulation protocols.

29.03 Explain the major components in a networked simulation or model.

30.0 Explain object models. – The student will be able to:

30.01 Describe objects using object oriented design (OOD).

30.02 Distinguish between abstract and real objects.

30.03 Explain why object oriented design is an effective programming paradigm.

30.04 Implement classes and methods.

30.05 Describe the benefits of object oriented concepts.

30.06 Describe object oriented design (OOD) using pseudo-code or Unified Modeling Language (UML).

31.0 Demonstrate an understanding of mathematical modeling in relation to the production process. – The student will be able to:

31.01 Explain mathematical modeling as processes.

31.02 Explain the role of modeler in mathematical modeling.

31.03 Identify job titles associated with mathematical modeling.

31.04 Explain the modeling production pipeline as it relates to mathematical modeling.

32.0 Demonstrate an understanding of 3D modeling and simulation software engines. – The student will be able to:

32.01 Understand concepts of the transfer of training.

32.02 Understand mathematics of physics based real-time simulators.

32.03	Describe components of visual systems (image generation, databases and displays).
32.04	Describe theory of motion/control loading simulation and cue synchronization.
32.05	Describe trainee station design, sensor simulation and instructor/operator station design.
32.06	Understand and utilize collision detection.
33.0	Understand systems engineering for simulators. – The student will be able to:
33.01	Understand the systems engineering life cycle process and terminology.
33.02	Identify the major milestones in the system life cycle.
33.03	Understand the Systems Engineering life cycle process and terminology including the following: system requirements analysis, system design, hardware design and development, software design and development, system integration, configuration management, acceptance testing and contractor logistics support.
33.04	Identify major milestones in the system life cycle such as preliminary/critical design reviews, establish function baseline, allocated baseline, product baseline and ready for training (RFT).
34.0	Analyze numerical characteristics of univariate data sets to describe patterns and departure from patterns, using statistics for various distributions. – The student will be able to:
34.01	Define terminology associated with data collection, statistics and graphing.
34.02	Differentiate between the various methods of data collection.
34.03	Explain the uses of random number generators.
34.04	Recognize various sources of bias in data collection.
34.05	Prepare a sample data collection.
34.06	Determine the numerical characteristics of a data set and analyze data.
34.07	Interpret tables of statistics.
34.08	Create bar charts and pie graphs with appropriate software.
34.09	Analyze the data to solve a presented problem.
34.10	Apply problem analysis using flowcharts or the Unified Modeling Language (UML).
35.0	Perform program maintenance to troubleshoot and optimize code. – The student will be able to:
35.01	Review requested modification of programs and establish a plan of action.
35.02	Design needed modifications in compliance with established standards.

35.03	Code, test, and debug modifications prior to updating production code.
35.04	Update production programs and documentation with changes.
35.05	Analyze output to identify and annotate errors or enhancements.
36.0	Use innovative technologies to create prototypes of models. – The student will be able to:
36.01	Identify emerging technologies to develop prototypes.
36.02	Compare and contrast the benefits and limitations of using various prototyping methods and costs.
36.03	Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).
37.0	Develop and program complex artificial intelligence systems (AI). The student will be able to:
37.01	Design intelligent interactions between players and AI.
37.02	Implement different complex AI algorithms.
37.03	Develop pathfinding systems for AI.
38.0	Identify functions of advance memory and information processing. The student will be able to:
38.01	Manipulate data between numbering systems. (binary, decimal, hexadecimal).
38.02	Identify how numeric and non-numeric data are represented in memory.
38.03	Identify the characteristics and properties of reference variables and pointers.
38.04	Apply efficient memory management techniques to prevent memory leaking.

**Course Number: CTS0774**

**Occupational Completion Point: E**

**Modeling & Simulation Developer –450 Hours – SOC Code 15-1131**

39.0 Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices. – The student will be able to:

39.01 Compare and contrast the appropriate use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).

39.02 Demonstrate proficiency in the use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).

40.0 Build a simple scenario for experimentation or training. – The student will be able to:

40.01 Explain the importance of scenario building in simulations.

40.02 Identify the building blocks of scenarios.

40.03 Design a storyboard for a simulation.

40.04 Build a simple simulation with a finite number of variables.

40.05 Identify the various components of a simulation.

40.06 Run a simulation application given specific parameters.

40.07 Explain verification and validation of a simulation.

40.08 Review the importance of scenario building in simulations.

40.09 Explore/develop building blocks of scenarios.

40.10 Design a detailed storyboard for a simulation.

40.11 Build a simulation with a level of fidelity.

40.12 Describe the history of gaming and evolution of video games.

40.13 Design games using programming techniques.

40.14 Implement a simple game using appropriate software.

41.0 Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation. – The student will be able to:

41.01 Use proper attributes to develop a flowchart.

41.02 Compare various types of studies (i.e. survey, observation, experiment).

41.03	Identify and explain an experimental design process.
41.04	Set realistic objectives for the experiment.
41.05	Determine the appropriate response or output.
41.06	Select process variables or design parameters (control factors), noise factors and the interactions among the process variables of interest.
41.07	Perform experimental design execution.
41.08	Check that the data are consistent with the experimental assumptions.
41.09	Interpret and present results.
42.0	Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error. – The student will be able to:
42.01	Define and explain probability rules and event terminology.
42.02	Identify events as complementary, dependent, independent, mutually exclusive or not mutually exclusive.
42.03	Analyze categorical data using two-way tables to describe patterns and departure from patterns and to find marginal frequency and relative frequencies.
42.04	Distinguish between empirical and theoretical probability.
42.05	Calculate probabilities.
42.06	Explain the law of large numbers.
42.07	Calculate probabilities using addition rules.
42.08	Calculate probabilities using the multiplications rules.
42.09	Define the Fundamental Counting Rule, Permutation, and Combination.
42.10	Perform calculations using the Fundamental Counting Rule, Permutation and Combination.
42.11	Distinguish when one would use a permutation and when one would use a combination.
42.12	Define experimental terminology.
42.13	Explain potential reasons for experimental error.
42.14	Demonstrate an understanding of the principles of probability by performing a probability experiment within the classroom.

43.0	Use innovative technologies to create prototypes of models. – The student will be able to:
43.01	Identify emerging technologies to develop prototypes.
43.02	Compare and contrast the benefits and drawbacks of using various prototyping methods and costs.
43.03	Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).
44.0	Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production. – The student will be able to:
44.01	Identify the usefulness of technology applications.
44.02	Determine the design architecture.
44.03	Formulate and test a proof of concept.
44.04	Understand the value of partnerships and sub-contracting of production and distribution of product.
44.05	Develop an understanding of the production process.
44.06	Understand return on investment (ROI) concepts.
44.07	Examine market analysis of product.
44.08	Develop a comprehensive business model and present a clear and professional proposal to investors.
45.0	Demonstrate information fluency using emerging research techniques and technology. – The student will be able to:
45.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
45.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
45.03	Use technology tools to collaborate and generate a deliverable product.
45.04	Develop and display an electronic portfolio.
45.05	Demonstrate research skills using browsers, search engines, directories, and databases.
45.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
45.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
45.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
45.09	Identify effective Boolean search strategies.

45.10 Correlate the use of social media in the field of modeling and simulation for a variety of purposes.

45.11 Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).



## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Modeling Simulation Design  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y500300
CIP Number	0511080403
Grade Level	30, 31
Standard Length	1500 hours
Teacher Certification	Refer to the <b>Program Structure</b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 15-1132 – Software Developers, Applications 27-1014 - Multimedia Artists and Animators
Basic Skills Level	Mathematics: 10 Language: 10 Reading: 10

**Purpose**

The Modeling Simulation Design program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster and the expansive employment opportunities in the field of Modeling and Simulation. This course provides technical skill proficiency and includes competency-based applied learning through the use of hands-on labs and the development of a multi-year portfolio. Students will build academic knowledge, enhance higher-order reasoning and problem-solving skills, develop leadership and collaboration abilities and refine general employability and occupation-specific skills.

The content includes but is not limited to practical experiences in modeling and simulation conceptualization, design, storyboarding, development methodologies, essential programming techniques, prototype development, production processes and implementation challenges. Science, Computer Programming, Math, 2D and 3D Art are embedded throughout the program to emphasize the relationship between these areas and the field of Modeling and Simulation. To further enrich this course sequence it is recommended students take a sequence of electives in either visual

arts, computer arts, or digital arts including but not limited to Computer Programming, Web Design, 2D and 3D Art, Gaming and Animation, Robotics and/or Geospatial/Geographic Information Systems Technology.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of five occupational completion points.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	CTS0770	Modeling & Simulation Technician	COMPU SCI 6	150 hours	15-1199
B	CTS0771	Modeling & Simulation 2D Artist	ENG&TEC ED1@2	300 hours	27-1014
C	CTS0772	Modeling & Simulation 3D Artist	TEC ED 1 @2	300 hours	27-1014
D	CTS0773	Modeling & Simulation Technical Artist	ENG 7G	300 hours	27-1014
E	CTS0774	Modeling & Simulation Developer	ENG TECH 7G INFO TECH 7G COMP PROG 7G ROBOTICS 7G BUS ED 1 @2 TV PRO TEC @7 7G COMM ART @7 7G	450 hours	15-1132

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## **Standards**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge.
- 02.0 Demonstrate information fluency using emerging research techniques and technology.
- 03.0 Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation.
- 04.0 Explain intelligent systems as they relate to modeling, simulation and data analysis.
- 05.0 Demonstrate knowledge of different operating systems
- 06.0 Explore software evolution and lifecycle as it relates to modeling and simulation
- 07.0 Understand the production process of modeling, simulation and entertainment.
- 08.0 Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets.
- 09.0 Demonstrate production use of high-end Game Engines.
- 10.0 Categorize the different gaming genres.
- 11.0 Describe the game development life cycle.
- 12.0 Develop a game design document.
- 13.0 Identify gameplay elements and their characteristics.
- 14.0 Explore the methods used to create and sustain player immersion.
- 15.0 Describe the general principles of storytelling.
- 16.0 Demonstrate an understanding of visual modeling in relation to the production process.
- 17.0 Understand the role of texture artists in relation to the production process.
- 18.0 Demonstrate knowledge of basic lighting.
- 19.0 Demonstrate knowledge of basic animation.
- 20.0 Demonstrate knowledge of photo editing software.
- 21.0 Demonstrate knowledge of video editing software.
- 22.0 Utilize basic audio production techniques, sound construction, and editing techniques as related to modeling and simulation.
- 23.0 Create and design a vector or bitmap art reference to develop a texture map to build a 3D model for simulation.
- 24.0 Demonstrate the use of experimental and engineering design techniques to produce real world or industry simulations.
- 25.0 Identify gameplay elements and their characteristics.
- 26.0 Explore the methods used to create and sustain player immersion.
- 27.0 Describe the general principles of storytelling.
- 28.0 Develop effective user interfaces (UI).
- 29.0 Explore the foundations of Digital Painting and Art.
- 30.0 Explore 2D texture painting techniques using painting software.
- 31.0 Demonstrate knowledge of basic materials and textures.
- 32.0 Apply industry standards for 3D animation software and user interface to create 3D simple and complex models.
- 33.0 Demonstrate basic understanding of modeling principles.
- 34.0 Explain environmental models.
- 35.0 Use visual modeling techniques and software to create an environmental model.

- 36.0 Demonstrate knowledge of basic 3D rendering.
- 37.0 Demonstrate knowledge of polygon modeling.
- 38.0 Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling.
- 39.0 Demonstrate knowledge of animation principles as it relates to the underlying physics of modeling.
- 40.0 Analyze model fidelity as related to modeling and simulation techniques.
- 41.0 Demonstrate knowledge of rigging.
- 42.0 Demonstrate knowledge of basic character setup.
- 43.0 Demonstrate knowledge of motion capture systems.
- 44.0 Explore 3D sculpting and texturing techniques using high polygon sculpting software.
- 45.0 Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices.
- 46.0 Build a simple scenario for experimentation or training.
- 47.0 Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation.
- 48.0 Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error.
- 49.0 Use innovative technologies to create prototypes of models.
- 50.0 Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production.
- 51.0 Demonstrate information fluency using emerging research techniques and technology.

Florida Department of Education  
Student Performance Standards

Program Title: Modeling Simulation Production  
Career Certificate Program Number: Y500300

<b>Course Number: CTS0770</b>	
<b>Occupational Completion Point: OCP A</b>	
<b>Modeling &amp; Simulation Technician – 150 Hours – SOC Code 15-1199</b>	
01.0	Demonstrate an understanding of essential modeling and simulation terms by using them as they relate to specific careers requiring modeling and simulation skills and knowledge. – The student will be able to:
01.01	Define and explain essential modeling and simulation terms and concepts.
01.02	Identify disciplines which use modeling and simulation tools and discuss their real world applications.
01.03	Identify modeling and simulation related careers and the educational and professional requirements for various fields.
01.04	Compare and contrast the central modeling and simulation concepts and careers.
01.05	Explain the past, present, and future importance of modeling and simulation.
02.0	Demonstrate information fluency using emerging research techniques and technology. – The student will be able to:
02.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
02.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
02.03	Use technology tools to collaborate and generate a deliverable product.
02.04	Develop and display an electronic portfolio.
02.05	Demonstrate research skills using browsers, search engines, directories, and databases.
02.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
02.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
02.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
02.09	Identify effective Boolean search strategies.



02.10	Correlate the use of social media in the field of modeling and simulation for a variety of purposes.
02.11	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).
03.0	Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation. – The student will be able to:
03.01	Explain how information technology and modeling and simulation impact the operation and management of business and society.
03.02	Explain the emergence of e-commerce and e-government and the potential impact on business and society.
03.03	Trace the evolution of the Internet from its inception to the present and into the future.
03.04	Analyze physical models and organize them conceptually based on their development and historical relevance.
03.05	Use graphic technology to create a visualization of a historic simulator or synthetic environment that has evolved over time.
03.06	Describe the evolution of the digital computer as it relates to modeling and simulation.
03.07	Explain the need for and use of input devices and displays to design and create models and simulations.
03.08	Demonstrate an understanding of storage management (e.g., hard drive, floppy disk) as it relates to creating and storing digital models and simulations.
03.09	Identify the advantages and limitations of computer-generated models and simulation.
04.0	Explain intelligent systems as they relate to modeling, simulation and data analysis. – The student will be able to:
04.01	Define intelligent system.
04.02	Explain and examine structured logic and semantics.
04.03	Explain the use of intelligent systems.
04.04	Examine programs using the elements of an intelligent system.
05.0	Demonstrate knowledge of different operating systems. – The student will be able to:
05.01	Explain the history and purpose of various operating systems (e.g., DOS, Windows, Mac, and Unix/Linux).
05.02	Discuss the impact of RAM and ROM technology on the development of the modern computer operating systems and microcomputers.
05.03	Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).
05.04	Identify the internal components of a computer (e.g., power supply, hard drive, motherboard, input/output (I/O) cards/ports, cabling).
05.05	Identify the different control systems for simulation.
05.06	Explain the factors that can limit the simulation capabilities of personal computers.

06.0	Explore software evolution and lifecycle as it relates to modeling and simulation. – The student will be able to:
06.01	Explain software and hardware lifecycles and their steps.
06.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.0	Understand the production process of modeling, simulation and entertainment. – The student will be able to:
07.01	Explain software and hardware lifecycles and their steps.
07.02	Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.
07.03	Demonstrate speed and efficiency concepts.
07.04	Demonstrate use of a production pipeline.
07.05	Identify the departments of an animation studio
07.06	Describe the interrelationships among departments.
07.07	Demonstrate basic communication concepts (verbal, memos, paperwork).
07.08	Identify the stages of production.
07.09	Correctly use studio terms and jargon.
07.10	Create and organize production paperwork into design/production documentation.
07.11	Identify target audiences, markets, and demographics.
07.12	Demonstrate ability to write a professionally formatted script.
07.13	Demonstrate ability to breakdown a script into production elements (cast, props).
07.14	Demonstrate understanding of visual storytelling and how storyboards are used during production.
08.0	Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets. – The student will be able to:
08.01	Practice ethical behaviors regarding copyright, citation, and plagiarism.
08.02	Understand the process of patent application filing, product trials, and communication techniques to describe their product.
08.03	Explain the purposes of copyrights, trademarks, and patents and understand the limitations and expectations.
08.04	Explore and examine components of intellectual property such as patents, copyrights, trademarks, and trade secrets.

08.05	Understand “Fair Use and Fair Dealing” practices.
08.06	Understand the transfer and licensing of creative works.
08.07	Understand the use of “exclusive rights” to intellectual creations.
08.08	Utilize digital watermarking.
09.0	Demonstrate production use of high-end Game Engines. – The student will be able to:
09.01	Demonstrate working knowledge of interface and workspace.
09.02	Setup projects properly.
09.03	Create and transform game objects and edit their properties.
09.04	Create and use collision models and triggers.
09.05	Setup and modify camera.
09.06	Apply input data into game systems.
09.07	Implement animation setup.
09.08	Create and modify particle systems and their properties.
09.09	Design and implement visual effects using compositing techniques.
09.10	Develop, test and implement game scripts.
10.0	Categorize the different gaming genres. – The student will be able to:
10.01	Research, compare and categorize different game genres.
10.02	Analyze examples of different gaming genres.
10.03	Define and use the necessary vocabulary related to gaming and the different game genres.
11.0	Describe the game development life cycle. – The student will be able to:
11.01	Identify steps in the pre-production process including the proof of concept and market research.
11.02	Describe the iterative prototyping process (e.g., Alpha, Beta).
11.03	Determine platform, technology and scripting requirements.

11.04	Implement techniques of scenario development, levels, and missions.
11.05	Discuss game testing requirements and methods.
12.0	Develop a game design document. – The student will be able to:
12.01	Evaluate and discuss the choice of delivery system.
12.02	Evaluate and discuss choices of genre, game design software, art, digital media, and animation software.
12.03	Create a game strategy overview, character overview, and storyboard overview.
12.04	Define the rules of play and multi-player options.
12.05	Create the layout and interfaces overview and digital media overview.
12.06	Determine the gameplay interaction requirements and create the progression levels overview.
12.07	Define strategic positioning of game immersion dynamics and psychological effect.
12.08	Identify hardware and software constraints.
13.0	Identify gameplay elements and their characteristics. – The student will be able to:
13.01	Analyze and deconstruct game environments and interactions.
13.02	Compare and contrast popular games and simulations in terms of player interaction, plot complexity, and rewards.
13.03	Categorize gameplay elements by player types and target audience.
14.0	Explore the methods used to create and sustain player immersion. – The student will be able to:
14.01	Research and define the term “immersion”.
14.02	Explore and explain factors that create player immersion in a game or simulation.
14.03	Examine games and simulations and explain the methods each one uses to increase player immersion.
15.0	Describe the general principles of storytelling. – The student will be able to:
15.01	Identify the essential elements of a story.
15.02	Describe how creative writing is used as a game design tool.
15.03	Compare and contrast methods of delivering a story in a game.

**Course Number: CTS0771**  
**Occupational Completion Point: OCP B**  
**Modeling & Simulation 2D Artist – 300 Hours – SOC Code 27-1014**

16.0 Demonstrate an understanding of visual modeling in relation to the production process. – The student will be able to:

16.01 Explain visual modeling as a process.

16.02 Explain the role of a modeler in visual modeling.

16.03 Identify job titles associated with visual modeling.

16.04 Explain the modeling production pipeline as it relates to visual modeling.

17.0 Understand the role of texture artists in relation to the production process. – The student will be able to:

17.01 Define texturing as a process.

17.02 Define the role of texture artist.

17.03 Identify job titles associated with texture artist.

17.04 Identify texture creation in the production pipeline.

17.05 Demonstrate knowledge of the difference between textures and shades.

18.0 Demonstrate knowledge of basic lighting. – The student will be able to:

18.01 Compare and contrast real lighting with 3D lighting.

18.02 Demonstrate an understanding of 3 point lighting (key, fill, back).

18.03 Demonstrate an understanding of low-key and high-key lighting.

18.04 Use include/exclude commands to target light on objects.

18.05 Demonstrate use of negative intensity.

19.0 Demonstrate knowledge of basic animation. – The student will be able to:

19.01 Apply animation principles to object animation.

19.02 Demonstrate an understanding of animation timelines.

19.03 Demonstrate an understanding of key framing.

19.04	Record and edit keyframes.
19.05	Demonstrate an understanding in the use of controllers.
19.06	Render basic reference animation.
20.0	Demonstrate knowledge of photo editing software. – The student will be able to:
20.01	Demonstrate understanding file formats and storage options.
20.02	Identify parts of the software interface (menus/palettes).
20.03	Demonstrate ability to use each of the basic tool sets.
20.04	Demonstrate ability to import, export and save images.
20.05	Demonstrate understanding of layers and channels.
20.06	Demonstrate understanding of filters, effects and plug-ins.
20.07	Demonstrate understanding of file presets.
20.08	Demonstrate ability to select portions of an image for manipulation.
20.09	Demonstrate ability to transform selections and images (crop, scale).
20.10	Demonstrate ability to color correct images (brightness, hue, contrast).
20.11	Demonstrate ability to use brushes for image creation and correction.
20.12	Understand non-destructive and destructive operations.
20.13	Demonstrate the ability to import, paint and export 3D objects.
21.0	Demonstrate knowledge of video editing software. – The student will be able to:
21.01	Demonstrate understanding file formats and storage options.
21.02	Identify parts of the software interface (menus/palettes).
21.03	Demonstrate ability to use each of the basic tool sets.
21.04	Demonstrate ability to import, export and save video.
21.05	Demonstrate understanding of layers and compositing.
21.06	Demonstrate understanding of filters, effects and plug-ins.

21.07	Demonstrate understanding of file presets.
21.08	Demonstrate understanding of rendering process.
21.09	Demonstrate ability to transform video (crop, scale).
21.10	Demonstrate ability to color correct images (brightness, hue, contrast).
21.11	Demonstrate ability to use brushes for image creation and correction.
21.12	Understand non-destructive and destructive operations.
21.13	Demonstrate the compositing integration of rendered 3D animation with video.
22.0	Utilize basic audio production techniques, sound construction, and editing techniques as related to modeling and simulation. – The student will be able to:
22.01	Describe the use of digital recording decks and other digital storage devices.
22.02	Describe the function and operation of digital audio workstations.
22.03	Edit, cut, erase, and insert sound utilizing various digital production techniques.
22.04	Perform digital noise reduction and noise extraction via spectral display.
22.05	Survey and discuss the use of naming conventions and temp sounds.
22.06	Demonstrate an understanding of various audio construction software.
22.07	Analyze and discuss methods of matching sound effects to art assets.
22.08	Identify and categorize commonly used technology sound engine integration equipment.
22.09	Identify and discuss resources such as sound effects libraries.
22.10	Examine methods of sound implementation and associated software.
22.11	Explain how and why digital video may be integrated into a model or simulation design.
22.12	Explain the roles and responsibilities of the sound design team.
22.13	Describe the use of 3D and surround sound.
22.14	Apply knowledge of distance/spatial effects, including surround sound, in a game/simulation.
22.15	Analyze the relationship of the audio environment to the visual environment.

23.0	Create and design a vector or bitmap art reference to develop a texture map to build a 3D model for simulation. – The student will be able to:
23.01	Know the difference between vectors and bitmaps.
23.02	Demonstrate an understanding of various 2D art programs.
23.03	Utilize the programs tools and brushes.
23.04	Know the importance of layers.
23.05	Identify file formats.
23.06	Use digital media software to create a vector or bitmap reference object.
23.07	Import a reference object into 3D modeling software.
23.08	Convert a reference object to 3D.
24.0	Demonstrate the use of experimental and engineering design techniques to produce real world or industry simulations. – The students will be able to:
24.01	Understand the design requirements and limitations of a 2D modeling and simulation engine.
24.02	Demonstrate the use of various mediums and mixed media (traditional or digital) in a 2D modeling and simulation.
24.03	Demonstrate the ability to create character and object views for animation.
24.04	Break down animation into a series of pictures to import animation to a modeling and simulation engine.
24.05	Demonstrate the effective use of animation loops and cycles in a modeling and simulation engine.
24.06	Demonstrate an understanding of the value of timing to convey character motion.
24.07	Demonstrate the effective use of animation arcs for the articulation of body elements.
24.08	Demonstrate the use of principles of animation such as anticipation, squash, stretch, weight, exaggeration and overlapping secondary motion.
24.09	Demonstrate the use of phonemes to display speech in animation.
25.0	Identify gameplay elements and their characteristics. – The student will be able to:
25.01	Analyze and deconstruct game environments and interactions.
25.02	Compare and contrast popular games and simulations in terms of player interaction, plot complexity, and rewards.
25.03	Categorize gameplay elements by player types and target audience.



26.0	Explore the methods used to create and sustain player immersion. – The student will be able to:
26.01	Research and define the term “immersion”.
26.02	Explore and explain factors that create player immersion in a game or simulation.
26.03	Examine games and simulations and explain the methods each one uses to increase player immersion.
27.0	Describe the general principles of storytelling. – The student will be able to:
27.01	Identify the essential elements of a story.
27.02	Describe how creative writing is used as a game design tool.
27.03	Compare and contrast methods of delivering a story in a game.
28.0	Develop effective user interfaces (UI). – The student will be able to:
28.01	Utilize various design techniques for UI development.
28.02	Create clear, concise, responsive UI.
28.03	Provide efficient feedback while interacting with the UI.
29.0	Explore the foundations of Digital Painting and Art. – The student will be able to:
29.01	Demonstrate knowledge of lines, shapes and values.
29.02	Explain the importance of Value in digital painting and composition.
29.03	Explain what Color Theory is and why it is important to design and composition.
29.04	Demonstrate skill in drawing construction, thumbnails and clean lines.
29.05	Demonstrate skill of blend and brush tools.
29.06	Sketch base objects in perspective.
29.07	Explain what makes a compelling composition and why it is important.
29.08	Explain the importance of art studies and history.
29.09	Create a landscape digital painting for use in game engine.

30.0 Explore 2D texture painting techniques using painting software. – The student will be able to:

30.01 Explain the differences between hard and soft surfaces

30.02 Demonstrate skill in painting organic materials, texture, cloth, wood and metal.

30.03 Demonstrate proper technique in applying painted materials to scenes and objects.

**Course Number: CTS0772**  
**Occupational Completion Point: OCP B**  
**Modeling & Simulation 3D Artist – 300 Hours – SOC Code 27-1014**

31.0 Demonstrate knowledge of basic materials and textures. – The student will be able to:

31.01 Demonstrate an understanding of material and texture storage.

31.02 Apply textures to an object.

31.03 Demonstrate an understanding of procedural shaders.

31.04 Demonstrate an understanding of channels.

31.05 Adjust the transparency, luminance, and reflection of a material.

31.06 Demonstrate an understanding of displacement maps.

31.07 Demonstrate an understanding of bump maps.

31.08 Demonstrate knowledge of material projections.

31.09 Demonstrate an understanding of UV mapping.

31.10 Demonstrate an understanding of 3D painting.

31.11 Understand how light affects the look of materials.

31.12 Understand how camera angles can affect the look of materials.

32.0 Apply industry standards for 3D animation software and user interface to create 3D simple and complex models. – The student will be able to:

32.01 Identify the computer requirements for 3D animation software.

32.02 Compare and contrast available 3D animation software.

32.03 Identify available file formats and protocols.

32.04 Explain the cinematic stage paradigm in 3D software.

32.05 Demonstrate an understanding of naming conventions.

32.06 Develop software and file backup plan.

32.07	Identify common icons within the software.
32.08	Demonstrate use of keyboard shortcuts.
32.09	Understand the use of a three-button mouse.
32.10	Identify the main windows of a 3D program.
32.11	Identify common window layouts.
32.12	Identify tool icons within the software.
32.13	Understand the significance of keyboard shortcut use and efficiency.
32.14	Demonstrate an understanding of the Euclidean Geometry Model (x-y-z coordinate system).
32.15	Demonstrate an understanding of attribute managers.
32.16	Demonstrate an understanding of layers.
32.17	Navigate the modeling window using pan, rotate, and zoom controls.
32.18	Demonstrate knowledge of selection tools (lasso, loop).
32.19	View objects in wireframe, gourard shading, lines, boxes and modes.
32.20	Demonstrate use of selection sets.
32.21	Undo and redo an action within the program.
32.22	Locate the help menu system.
33.0	Demonstrate basic understanding of modeling principles. – The student will be able to:
33.01	Understand 3D construction theory.
33.02	Demonstrate an understanding of primitives and parametric modeling.
33.03	Demonstrate an understanding of non-uniform rational basis spline (NURBS), splines, and polygonal modeling.
33.04	Demonstrate the ability to use reference images and files while modeling.

34.0	Explain environmental models. – The student will be able to:
34.01	Explain the use of environmental modeling.
34.02	Discuss how to model environmental effects.
34.03	Discuss the effects of environmental simulations on related simulations.
34.04	Examine environmental models available on the internet.
35.0	Use visual modeling techniques and software to create an environmental model. – The student will be able to:
35.01	Demonstrate information fluency by conducting research need to create an environmental model.
35.02	Use modeling techniques and software to create a basic environmental model.
35.03	Communicate the relevance of the model and its impact on the real world.
36.0	Demonstrate knowledge of basic 3D rendering. – The student will be able to:
36.01	Demonstrate an understanding of processor, hardware and software rendering techniques.
36.02	Determine the final render format (size, codec, quality).
36.03	Demonstrate an understanding of basic render settings.
36.04	Select the range of frames to be rendered.
37.0	Demonstrate knowledge of polygon modeling. – The student will be able to:
37.01	Demonstrate an understanding of N-gons.
37.02	Demonstrate an understanding of subdivision.
37.03	Demonstrate basic polygon editing and manipulation.
37.04	Demonstrate knowledge of point management (location).
37.05	Demonstrate the ability to create polygonal models from points.
37.06	Demonstrate an understanding of cutting/division tools.
37.07	Demonstrate an understanding of extrudes.

37.08	Demonstrate an understanding of symmetry.
37.09	Demonstrate an understanding of hyper NURBS.
37.10	Demonstrate an understanding of basic deformers (bend, twist, melt).
38.0	Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling. – The student will be able to:
38.01	Demonstrate an understanding of points, vertices, edges, and polygons.
38.02	Demonstrate an understanding of poly-count.
38.03	Demonstrate an understanding of primitives.
38.04	Define parametric primitives.
38.05	Locate an object's properties, attributes, and coordinates.
38.06	Demonstrate understanding of Non uniform rational b-splines (NURBS).
38.07	Demonstrate understanding of splines and generators (extrude, lathe, sweep).
38.08	Understand the use of hierarchy.
38.09	Demonstrate an understanding of Boolean objects.
38.10	Demonstrate an understanding of Null objects.
38.11	Demonstrate an understanding of scene management (hiding-unhiding).
38.12	Demonstrate an understanding of arrays.
39.0	Demonstrate knowledge of animation principles as it relates to the underlying physics of modeling. – The student will be able to:
39.01	Demonstrate an understanding of the principle of squash and stretch.
39.02	Demonstrate an understanding of the principle of anticipation.
39.03	Demonstrate an understanding of the principle of staging.
39.04	Demonstrate an understanding of the principle of straight ahead action and pose to pose.
39.05	Demonstrate an understanding of the principle of follow through and overlapping action.

39.06	Demonstrate an understanding of the principle of slow in and slow out.
39.07	Demonstrate an understanding of the principle of arcs.
39.08	Demonstrate an understanding of the principle of secondary action.
39.09	Demonstrate an understanding of the principle of timing.
39.10	Demonstrate an understanding of the principle of exaggeration.
39.11	Demonstrate an understanding of the principle of solid drawing.
39.12	Demonstrate an understanding of the principle of appeal.

**Course Number: CTS0773**  
**Occupational Completion Point: OCP D**  
**Modeling & Simulation Technical Artist – 300 Hours – SOC Code 27-1014**

40.0 Analyze model fidelity as related to modeling and simulation techniques. – The student will be able to:

40.01 Define fidelity.

40.02 Discuss the ramifications of model fidelity parameters and their variations.

40.03 Select the proper level of fidelity to solve a given problem.

40.04 Identify the rationale for selecting fidelity level.

40.05 Adjust model fidelity parameters to meet output requirements.

41.0 Demonstrate knowledge of rigging. – The student will be able to:

41.01 Define rigging as a process.

41.02 Define the role of rigger.

41.03 Identify job titles associated with a rigger.

41.04 Identify rigging creation in the production pipeline.

42.0 Demonstrate knowledge of basic character setup. – The student will be able to:

42.01 Compare and contrast rigging approaches and styles.

42.02 Demonstrate an understanding of the rig as it relates to the model.

42.03 Demonstrate an understanding of skeletal systems.

43.0 Demonstrate knowledge of motion capture systems. – The student will be able to:

43.01 Understand knowledge of the history of motion capture.

43.02 Understand the awareness of emerging technologies in the industry.

43.03 Understand motion capture for 3D production.

44.0 Explore 3D sculpting and texturing techniques using high polygon sculpting software. The student will be able to:

44.01 Navigate 3D sculpting interface and workspace.



44.02 Create and Transform base object for sculpting.

44.03 Create subdivisions of objects for high poly sculpting.

44.04 Demonstrate working knowledge of sculpt and paint tools including creating sculpt layers and paint layers.

44.05 Create high detail models using sculpt and paint tools.

44.06 Demonstrate proficiency in Retopology.

44.07 Display sculpts through model viewport filters.

**Course Number: CTS0774**

**Occupational Completion Point: E**

**Modeling & Simulation Developer – 450 Hours – SOC Code 15-1131**

45.0 Demonstrate proficiency using various software applications while understanding the hardware requirements needed for modeling and simulations including processors, input/output (I/O) devices. – The student will be able to:

45.01 Compare and contrast the appropriate use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).

45.02 Demonstrate proficiency in the use of various software and visualization applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music).

46.0 Build a simple scenario for experimentation or training. – The student will be able to:

46.01 Explain the importance of scenario building in simulations.

46.02 Identify the building blocks of scenarios.

46.03 Design a storyboard for a simulation.

46.04 Build a simple simulation with a finite number of variables.

46.05 Identify the various components of a simulation.

46.06 Run a simulation application given specific parameters.

46.07 Explain verification and validation of a simulation.

46.08 Review the importance of scenario building in simulations.

46.09 Explore/develop building blocks of scenarios.

46.10 Design a detailed storyboard for a simulation.

46.11 Build a simulation with a level of fidelity.

46.12 Describe the history of gaming and evolution of video games.

46.13 Design games using programming techniques.

46.14 Implement a simple game using appropriate software.

47.0 Demonstrate an understanding of underlying principles of experimental simulation and how it relates to modeling and simulation. – The student will be able to:

47.01 Use proper attributes to develop a flowchart.

47.02 Compare various types of studies (i.e. survey, observation, experiment).

47.03	Identify and explain an experimental design process.
47.04	Set realistic objectives for the experiment.
47.05	Determine the appropriate response or output.
47.06	Select process variables or design parameters (control factors), noise factors and the interactions among the process variables of interest.
47.07	Perform experimental design execution.
47.08	Check that the data are consistent with the experimental assumptions.
47.09	Interpret and present results.
48.0	Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error. – The student will be able to:
48.01	Define and explain probability rules and event terminology.
48.02	Identify events as complementary, dependent, independent, mutually exclusive or not mutually exclusive.
48.03	Analyze categorical data using two-way tables to describe patterns and departure from patterns and to find marginal frequency and relative frequencies.
48.04	Distinguish between empirical and theoretical probability.
48.05	Calculate probabilities.
48.06	Explain the law of large numbers.
48.07	Calculate probabilities using addition rules.
48.08	Calculate probabilities using the multiplications rules.
48.09	Define the Fundamental Counting Rule, Permutation, and Combination.
48.10	Perform calculations using the Fundamental Counting Rule, Permutation and Combination.
48.11	Distinguish when one would use a permutation and when one would use a combination.
48.12	Define experimental terminology.
48.13	Explain potential reasons for experimental error.
48.14	Demonstrate an understanding of the principles of probability by performing a probability experiment within the classroom.

49.0	Use innovative technologies to create prototypes of models. – The student will be able to:
49.01	Identify emerging technologies to develop prototypes.
49.02	Compare and contrast the benefits and drawbacks of using various prototyping methods and costs.
49.03	Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).
50.0	Apply the principles of entrepreneurship to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production. – The student will be able to:
50.01	Identify the usefulness of technology applications.
50.02	Determine the design architecture.
50.03	Formulate and test a proof of concept.
50.04	Understand the value of partnerships and sub-contracting of production and distribution of product.
50.05	Develop an understanding of the production process.
50.06	Understand return on investment (ROI) concepts.
50.07	Examine market analysis of product.
50.08	Develop a comprehensive business model and present a clear and professional proposal to investors.
51.0	Demonstrate information fluency using emerging research techniques and technology. – The student will be able to:
51.01	Compare and contrast emerging technologies and describe how they impact business in the global marketplace (e.g., wireless, wireless web, cell phones, portables/handhelds, smart appliances, home networks, peer-to-peer).
51.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.
51.03	Use technology tools to collaborate and generate a deliverable product.
51.04	Develop and display an electronic portfolio.
51.05	Demonstrate research skills using browsers, search engines, directories, and databases.
51.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.
51.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.
51.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing).
51.09	Identify effective Boolean search strategies.

51.10 Correlate the use of social media in the field of modeling and simulation for a variety of purposes.

51.11 Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 10, Language 10, and Reading 10. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Web Development  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y700100
CIP Number	0511080100
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1199 – Computer Occupations, All Other
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers such as an Assistant Web Designer, a Web Designer, and Senior Web Designer in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to operating system commands and web document development, design, promotion and scripting.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

**Program Structure**

This program is a planned sequence of instruction consisting of four occupational completion points.



This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44(3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0070	Web Design Foundations	BUS ED 1 @2	150 hours	15-1199
	CTS0071	Web Interface Design	VOE @7	150 hours	15-1199
C	CTS0049	Web Scripting	TC COOP ED @7	150 hours	15-1199
	CTS0015	Web Media Integration	BUS DP @7 %G	150 hours	15-1199
D	CTS0016	Web E-commerce	ELECT DP @7 %G	150 hours	15-1199
	CTS0017	Web Interactivity	CLERICAL @7 7G	150 hours	15-1199
			SECRETAR 7G		
TEC ELEC \$7 G					
			COMP SCI 6		
			COMM ART @7 7G		
			WEB DEV 7 G		

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Demonstrate proficiency setting website project requirements during the design phase and project planning phase of web development.
- 16.0 Demonstrate proficiency creating a logical website file structure.
- 17.0 Create basic webpages that meet the industry standards as set forth by the W3C (World Wide Web Consortium).
- 18.0 Incorporate images and graphical formatting on a webpage.
- 19.0 Create a basic table structure.
- 20.0 Incorporate form structures in a webpage.
- 21.0 Discuss appropriate use of frame structures and their outdated usage.
- 22.0 Understand the basic principles of Cascading Style Sheets-CSS.
- 23.0 Use CSS to create basic webpages based on industry standards.
- 24.0 Develop website page layout using AP (Absolute Positioning) elements.
- 25.0 Understand basic web design technology.
- 26.0 Describe the process for publishing a website.
- 27.0 Describe how website performance is monitored and analyzed.
- 28.0 Create an informational website that conforms to industry standards as set forth by the W3C.
- 29.0 Demonstrate efficient, consistent website development practice (use of templates, snippets).
- 30.0 Demonstrate language arts knowledge and skills.
- 31.0 Demonstrate mathematics knowledge and skills.
- 32.0 Incorporate Human Computer Interface (HCI) principles of design.

- 33.0 Research and obtain information for use in designing the user interface.
- 34.0 Create a user friendly interface using Cascading Style Sheets (CSS).
- 35.0 Create a CSS formatted informational website.
- 36.0 Demonstrate proficiency publishing, testing, monitoring, and maintaining a website.
- 37.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 38.0 Solve problems using critical thinking skills, creativity and innovation.
- 39.0 Describe the roles within teams, work units, departments, larger environment as it relates to website project management.
- 40.0 Describe the importance of professional ethics and legal responsibilities as it relates to website development.
- 41.0 Discuss the differences between server-side and client-side scripting.
- 42.0 Demonstrate understanding of the Document Object Model (DOM).
- 43.0 Design, write, debug, and incorporate a JavaScript client-side script into a webpage.
- 44.0 Incorporate basic JavaScript form validation and form handling (using pre-built validation scripts or online libraries).
- 45.0 Use advanced JavaScript techniques.
- 46.0 Demonstrate understanding of JavaScript accessibility issues.
- 47.0 Select and modify appropriate library and pre-built JavaScript to incorporate into webpage.
- 48.0 Demonstrate understanding of XML vocabularies and documents.
- 49.0 Create and debug an XML Document.
- 50.0 Demonstrate an understanding of Asynchronous JavaScript and XML (AJAX) and its implications for web developers.
- 51.0 Plan and implement a multi-page website that features graphics, pictures, and video galleries using AJAX techniques.
- 52.0 Incorporate Canvas API methods into a webpage.
- 53.0 Demonstrate an understanding of PHP scripting.
- 54.0 Design, write, debug, and incorporate a PHP client-side script into a webpage.
- 55.0 Demonstrate an understanding of databases.
- 56.0 Incorporate a database into a webpage.
- 57.0 Demonstrate knowledge and skills necessary to setup a secure E-commerce site.
- 58.0 Identify security issues associated with E-commerce and discuss methods to mitigate risks.
- 59.0 Apply skills necessary to setup an E-commerce storefront.
- 60.0 Employ techniques to enhance the value and profitability of an E-commerce website.
- 61.0 Develop an evaluation and performance monitoring framework featuring established metrics and target goals for an E-commerce website.
- 62.0 Demonstrate an understanding of Content Management Systems (CMS) and their implications for web development.
- 63.0 Use CMS features, functions, and extensions/modules to create/enhance a website.
- 64.0 Evaluate the suitability for and system requirements for a content management system.
- 65.0 Demonstrate an understanding of multimedia applications and their implications for web designers.
- 66.0 Create and incorporate interactive website components.
- 67.0 PDF document usage considerations.
- 68.0 Create, format, and manipulate PDF documents.
- 69.0 Display, distribution, and print considerations for PDF documents.
- 70.0 Create and manage PDF forms.
- 71.0 Incorporate PDF security in a PDF document.
- 72.0 Demonstrate proficiency using HTML5 features and functions.

**Florida Department of Education  
Student Performance Standards**

**Program Title: Web Development  
Career Certificate Program Number: Y700100**

**Course Number: OTA0040  
Occupational Completion Point: A  
Information Technology Assistant – 150 Hours – SOC Code 15-1151**

**Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.**

**Course Number: CTS0070**

**Occupational Completion Point: B**

**Web Design Foundations (Assistant Web Designer) – 150 Hours – SOC Code 15-1199**

15.0 Demonstrate proficiency setting website project requirements during the design phase and project planning phase of Web development. – The student will be able to:

15.01 Define information architecture.

15.02 Discuss the importance of information architecture to web design and development.

15.03 Conduct a client interview to determine the business purpose and needs.

15.04 Conduct a competitive analysis.

15.05 Describe the activities performed during the design phase and project planning phase of website development.

15.06 Demonstrate basic design principles (e.g., use of colors, proximity, rule of thirds, white space in the design of a website).

15.07 Define the site structure by creating a content map, site map, storyboard, associated wireframes, and web design comp for client approval.

15.08 Analyze and evaluate global site maps.

15.09 Discuss the legal and ethical issues (e.g., copyright laws, obtaining permission, public domain, proper citations) related to web design.

15.10 Describe accessibility and its implications on web design.

15.11 Identify the client and target audience needs, as well as the purpose of a website.

15.12 Describe project management responsibilities.

15.13 Define website project scope and scope creep.

15.14 Determine deadlines and deliverables for a website project.

15.15 Discuss Americans with Disabilities Act (ADA) standards for accessibility.

16.0 Demonstrate proficiency creating a logical website file structure. – The student will be able to:

16.01 Create an efficient, maintainable directory structure for a website, including the site root and subfolders for assets (e.g., images, templates, CSS).

16.02 Demonstrate and use correct file paths for relative, site root relative, and absolute links.

16.03 Apply acceptable and logical website file naming conventions (e.g., index.html, comments.htm, about\_us.htm).

16.04 Examine emerging and new markup languages.

16.05 Determine browser or platform compatibility as it relates to webpage design.

16.06	Identify common DOCTYPES (e.g., Strict, Transitional and Frameset, and HTML5) and describe their appropriate use.
17.0	Create basic webpages that meet the industry standards as set forth by the W3C (World Wide Web Consortium). – The student will be able to:
17.01	Create basic webpage structures using common markup elements and attributes.
17.02	Incorporate list structures in a webpage (e.g., ordered, unordered, definition).
17.03	Incorporate hyperlinks in a webpage (e.g., external, internal, email, named anchors).
17.04	Describe the influence of the W3C in the web development industry.
17.05	Write proper webpage syntax using tags and attributes that meet the standards set forth by the W3C.
17.06	Incorporate common webpage elements and attributes in a webpage (e.g., title, comment tags, id).
17.07	Differentiate between absolute and relative links used in a webpage.
17.08	Define and incorporate the target attribute for hyperlinks suitable for its purpose.
17.09	Use the HTML AUDIO and VIDEO tags to display a media file on the webpages.
18.0	Incorporate images and graphical formatting on a webpage. – The student will be able to:
18.01	Describe usage guidelines (e.g., format types, size, relevance) for integrating images and graphics onto a webpage.
18.02	Compare and contrast standard image formats used in webpage design.
18.03	Incorporate graphics into a webpage design.
18.04	Create and incorporate image maps in a webpage.
18.05	Optimize images and graphics for use in a webpage.
19.0	Create a basic table structure. – The student will be able to:
19.01	Describe how tables are used in web design.
19.02	Discuss the advantages and disadvantages of incorporating tables in a webpage design.
19.03	Define and modify table structures for the presentation of tabular information.
19.04	Create accessible tables using standard table elements and attributes.
20.0	Incorporate form structures in a webpage. – The student will be able to:
20.01	Create an accessible form using common elements, including form, fieldset, legend, textarea, select, option, button, labels, and input (radio, checkbox, submit, reset, image, password, hidden).

20.02	Describe and diagram the relationship between HTML forms and server-side technologies.
20.03	Compare and contrast the GET and POST methods for forms handling.
20.04	Define form validation and describe how it is accomplished.
20.05	List popular server-side technologies often used to process content sent from HTML forms.
20.06	Connect a HTML form to a server-side script for processing.
21.0	Discuss appropriate use of frame structures and their outdated usage. – The student will be able to:
21.01	Discuss using frames and iframe structures and the related security vulnerabilities
21.02	Describe appropriate uses of iframes.
22.0	Understand the basic principles of Cascading Style Sheets-CSS. – The student will be able to:
22.01	Define the purpose of CSS and describe its importance in web design.
22.02	Discuss existing and emerging CSS versions.
22.03	Explain how inheritance and specificity affect CSS rule conflicts.
22.04	Discuss the different placement of CSS (e.g., inline, external, embedded).
23.0	Use CSS to create basic webpages based on industry standards. – The student will be able to:
23.01	Recognize and use element selectors, ID selectors, class selectors, pseudo-class selectors, and descendant selectors.
23.02	Use inline, internal and external style sheets.
23.03	Use the link and import methods to connect to an external style sheet.
23.04	Apply basic CSS properties (background, border, color, float, font, height, line-height, list-style, margin, overflow, padding, position, text-align, text-indent, width, padding).
23.05	Use CSS to style tables (e.g., borders, width, spacing, alignment, background).
23.06	Use CSS to enhance the appearance and usability of an HTML form.
24.0	Develop website page layout using AP (Absolute Positioning) elements. – The student will be able to:
24.01	Compare and contrast positioning types on a webpage.
24.02	Describe the usage of AP elements in a webpage.



24.03	Incorporate AP elements in a webpage layout using appropriate Div tags.
24.04	Discuss the benefits and drawbacks of using AP elements for webpage layouts.
24.05	Determine how the stacking order and z-index impact webpages created with AP elements.
25.0	Understand basic web design technology. – The student will be able to:
25.01	Discuss client-side and server-side technologies.
25.02	Define e-commerce types and usage.
25.03	Describe database connectivity relative to websites.
26.0	Describe the process for publishing a website. – The student will be able to:
26.01	Explore domain name selection process.
26.02	Identify process to registering a domain name.
26.03	Compare and contrast hosting providers, features, and selection criteria.
26.04	Describe the various means for uploading website files (e.g., FTP, web-based tools).
27.0	Describe how website performance is monitored and analyzed. – The student will be able to:
27.01	Identify issues related to website maintenance.
27.02	Use webpage validation tools.
27.03	Describe website performance metrics (e.g., visits, time-on-page, time-on-site) and discuss their design implications.
27.04	Demonstrate knowledge of accessibility problems and solutions.
27.05	Discuss current basic Search Engine Optimization techniques.
27.06	Explore common website analytic tools.
28.0	Create an informational website that conforms to industry standards as set forth by the W3C. – The student will be able to:
28.01	Use GUI (Graphical User Interface) web authoring software to create a multi-page informational website.
28.02	Use image-editing software to enhance website designs with simple graphics.
28.03	Enhance the website using client-side technologies (navigation bars, rollover images or text, check plug-ins).

29.0	Demonstrate efficient, consistent website development practice (use of templates, snippets). – The student will be able to:
29.01	Produce website designs that would work equally well on various operating systems and platforms, browser versions/configurations, and devices.
29.02	Describe various file formats that can be imported onto a website (tabular data, word processing, presentation, PDFs).
30.0	Demonstrate language arts knowledge and skills. – The student will be able to:
30.01	Locate, comprehend and evaluate key elements of oral and written information.
30.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.
30.03	Present information formally and informally for specific purposes and audiences.
31.0	Demonstrate mathematics knowledge and skills. – The student will be able to:
31.01	Demonstrate knowledge of arithmetic operations.
31.02	Analyze and apply data and measurements to solve problems and interpret documents.
31.03	Construct charts/tables/graphs using functions and data.

**Course Number: CTS0071**  
**Occupational Completion Point: B**  
**Web Interface Design (Assistant Web Designer) – 150 Hours – SOC Code 15-1199**

32.0 Incorporate Human Computer Interface (HCI) principles of design. – The student will be able to:

32.01 Describe the fundamental design principles of human computer interface.

32.02 Differentiate between computer and human factors in screen/page design.

32.03 Describe what is meant by an “intuitive” interface.

32.04 Describe how typography, color scheme, and graphic usage are used to set website feel/tone for various types of websites (e.g., educational, entertainment, ecommerce). Identify and use the following design concepts: contrast, repetition, alignment, proximity, writing style.

32.05 Identify and use the following design concepts: contrast, repetition, alignment, proximity, writing style.

32.06 Define and establish logo, identity, and branding needed for an effective website.

32.07 Evaluate the HCI features included on a webpage storyboard.

32.08 Create a series of webpage storyboards that incorporate HCI design principles.

33.0 Research and obtain information for use in designing the user interface. – The student will be able to:

33.01 Identify common user information needs, information gathering models, and methods for gathering user research.

33.02 Define the primary audience and customer expectations.

33.03 Describe target audience preferences based on demographics (e.g., gender, age, economic status, culture).

33.04 Identify and use web analytic tools to shape an information architecture strategy (determine keywords).

33.05 Apply the results of research and analytics to the design of a user interface.

34.0 Create a user friendly interface using Cascading Style Sheets (CSS). – The student will be able to:

34.01 Create CSS styles suitable for use on a user friendly webpage interface.

34.02 Use element selectors, ID selectors, class selectors, pseudo-class selectors, and descendant selectors to create a table-less webpage design.

34.03 Create a series of templates formatted exclusively using CSS.

34.04 Use CSS syntax to configure and apply style sheets for multiple media displays (e.g., screen display and print).

34.05 Use CSS syntax to implement custom web fonts on a webpage.

34.06	Use CSS syntax to implement transitions and transformations to create animations on a webpage.
34.07	Use CSS media queries to develop a responsive user interface.
34.08	Explore various web authoring software (e.g. text editor or GUI editors).
34.09	Create documented CSS style sheets for layout and appearance purposes.
35.0	Create a CSS formatted informational website. – The student will be able to:
35.01	Use GUI (Graphical User Interface) web authoring software to create a multi-page informational website.
35.02	Create documented CSS style sheets for layout and appearance purposes.
35.03	Incorporate methods used to drive traffic to the website, then engage and retain visitors.
35.04	Apply standard search engine optimization (SEO) practices (e.g., keyword proximity; density; relevance; appropriate page titles, URLs, and headings, alt tags) to enhance search engine performance.
35.05	Use standard design techniques to create websites and correct display issues using multiple browsers and platforms.
35.06	Discuss the pros and cons of using existing and emerging animation software.
35.07	Use client-side technologies such as rollovers, check plug-ins, and pop-up windows to enhance the user interface.
36.0	Demonstrate proficiency publishing, testing, monitoring, and maintaining a website. – The student will be able to:
36.01	Recognize the relationship between local and remote site structure.
36.02	Identify methods of acquiring a domain name, appropriate hosting, and search engine registry.
36.03	Understand and implement strategies to measure website traffic and improve search engine analytics reports.
36.04	Describe the use of standard web marketing techniques.
36.05	Describe how social media and social networking sites can be used for marketing purposes.
36.06	Test websites using common resolutions, browsers, accessibility, and validation techniques.
36.07	Use popular Internet browsers and tools as defined by W3C Browser Statistics (e.g., Mozilla Firefox (Web Developer Toolbar, ColorZilla, MeasureIt, Firebug), Internet Explorer 7/8) to display and troubleshoot websites.
36.08	Explore standard practices for feedback and usability testing.
36.09	Identify and incorporate standard security measures in a website.
36.10	Identify and use online validation tools.
36.11	Change invalid markup to comply with standards.

36.12	Build a webpage that successfully passes the W3C validation test.
36.13	Write markup that facilitates accessibility.
36.14	Understand how to publish sites to remote server.
36.15	Differentiate between local, testing, and remote website files and storage.
37.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
37.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
37.02	Locate, organize and reference written information from various sources.
37.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.
37.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
37.05	Apply active listening skills to obtain and clarify information.
37.06	Develop and interpret tables and charts to support written and oral communications.
37.07	Exhibit public relations skills that aid in achieving customer satisfaction.
38.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
38.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
38.02	Employ critical thinking and interpersonal skills to resolve conflicts.
38.03	Identify and document workplace performance goals and monitor progress toward those goals.
38.04	Conduct technical research to gather information necessary for decision-making.
39.0	Describe the roles within teams, work units, larger environment as it relates to website project management. – The student will be able to:
39.01	Describe the types of websites and the major processes that make them successful.
39.02	Explain project management and team member key roles.
39.03	List and describe project management control systems (i.e., scope, timeframe, deliverables).
39.04	Explain the impact of the global economy and cultures on website planning and production.
40.0	Describe the importance of professional ethics and legal responsibilities as it relates to website development. – The student will be able to:
40.01	Evaluate and justify decisions based on ethical reasoning.

40.02 Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.

40.03 Identify and explain personal and corporate consequences of unethical or illegal practices in website development.

40.04 Interpret and explain written organizational policies and procedures.

**Course Number: CTS0049**

**Occupational Completion Point: C**

**Web Scripting (Web Designer) – 150 Hours – SOC Code 15-1199**

41.0 Discuss the differences between server-side and client-side scripting. – The student will be able to:

41.01 Describe the role scripting languages play in the creation of websites.

41.02	Identify and describe the advantages, disadvantages, and primary uses of popular scripting languages (e.g., JavaScript, VBScript, Perl, PHP, JScript).
42.0	Demonstrate understanding of the Document Object Model (DOM). – The student will be able to:
42.01	Describe the purpose of the Document Object Model (layout, objects, properties, methods).
42.02	Describe how JavaScript uses the DOM to detect and manipulate elements on a webpage.
43.0	Design, write, debug, and incorporate a JavaScript client-side script into a webpage. – The student will be able to:
43.01	Write, analyze and explain JavaScript syntax.
43.02	Describe usage of various data types.
43.03	Describe how the use of decision-making logic (AND, OR) is employed in a JavaScript program.
43.04	Create and use variables, operators, and expressions.
43.05	Use common JavaScript events and event handlers (e.g., click, load, onClick, onLoad) to control program flow, appearance, or functionality.
43.06	Understand and incorporate JavaScript arrays (e.g., array basics, types, usage, methods, sorting).
43.07	Understand and incorporate JavaScript functions (e.g., using the DOM, pass a value, return value, create objects, work with classes, objects).
43.08	Understand and incorporate JavaScript loops and conditions (e.g., loop basics, types, usage).
43.09	Recognize, isolate, and correct common JavaScript errors (e.g., syntax, function errors, reserved word usage, unsupported DOM).
43.10	Apply JavaScript best coding practices (i.e., properly documenting scripts, field naming conventions, writing understandable code).
43.11	Use different methods to incorporate JavaScript onto a webpage (e.g., <script> element, JavaScript statement block, external scripts).
43.12	Troubleshoot and test incorporated script (i.e., functionality, browser usage, resolve known bugs).
44.0	Incorporate basic JavaScript form validation and form handling (using pre-built validation scripts or online libraries). – The student will be able to:
44.01	Identify and use form elements to solicit user input.
44.02	Use JavaScript with HTML form controls.
44.03	Validate web forms prior to submission.
44.04	Use output commands to display processed data in an appropriately formatted form.
45.0	Use advanced JavaScript techniques. – The student will be able to:
45.01	Write JavaScript suitable for plug-in detection, image manipulation, and the creation of custom JavaScript objects.

45.02	Use JavaScript to incorporate, create, update, and delete cookies.
45.03	Describe the common security issues relevant to JavaScript.
46.0	Demonstrate understanding of JavaScript accessibility issues. – The student will be able to:
46.01	Describe the purpose of the Browser Object Model (BOM) and how it relates to JavaScript.
46.02	Make webpages accessible and functional when JavaScript is disabled or unsupported.
47.0	Select and modify appropriate library and pre-built JavaScript to incorporate into webpage. – The student will be able to:
47.01	Explore common JavaScript libraries and describe the advantages and disadvantages of using libraries.
47.02	Analyze pre-built library items to determine functionality.
47.03	Explain how a library item achieves desired processing.
47.04	Determine if pre-built script provides functionality required in an effective manner.
47.05	Incorporate pre-built library items into webpages.
47.06	Identify the restrictions related to using pre-built scripts (i.e.; copyright, processing, and length of script).
47.07	Modify pre-built scripts to suit functionality requirements.
47.08	Test and troubleshoot pre-built scripts and widgets incorporated into webpages.

**Course Number: CTS0015**  
**Occupational Completion Point: C**  
**Web Media Integration (Senior Web Designer) – 150 Hours – SOC Code 15-1199**

48.0	Demonstrate understanding of XML vocabularies and documents. – The student will be able to:
48.01	Understand XML vocabularies.
48.02	Define well-formed and valid XML documents.
48.03	Describe the basic structure of an XML document.



49.0	Create and debug an XML Document. – The student will be able to:
49.01	Create an XML declaration.
49.02	Work with XML comments.
49.03	Create XML elements and attributes.
49.04	Work with character and entity references.
49.05	Describe how XML handles character data, parsed character data, and white space.
49.06	Work with XML parsers.
49.07	Understand how web browsers work with XML documents.
49.08	Apply a style sheet to an XML document.
50.0	Demonstrate an understanding of Asynchronous JavaScript and XML (AJAX) and its implications for web developers. – The student will be able to:
50.01	Identify the technologies that comprise AJAX and explain how they interact.
50.02	Describe the purpose, advantages, disadvantages, and functions of AJAX.
50.03	Describe how AJAX works and how it is used in the creation of websites.
50.04	Define appropriate use of AJAX in a web project.
50.05	Identify AJAX Usability and Accessibility issues and their workarounds.
50.06	Describe AJAX related browser compatibility issues and their workarounds.
50.07	Explore popular AJAX applications currently on the Internet (auto-complete (Google), updating user content (Twitter), voting and rating (social bookmarking)).
50.08	Describe common security issues associated to AJAX.
50.09	Analyze the server-side implications of AJAX applications.
50.10	Explore methods for testing and maintaining an AJAX application.
50.11	Explore the future of AJAX and its implementation.
51.0	Plan and implement a multi-page website using AJAX techniques. – The student will be able to:
51.01	Research AJAX design principles and patterns (e.g., Observer, Command and MVC).
51.02	Research and compare popular AJAX frameworks, libraries, and toolkits (e.g., JQuery, DOJO, Prototype).

51.03	Identify and implement strategies for progressive enhancement of a webpage.
51.04	Update specific areas of a page with data from the server (e.g., server-login updated) without reloading the webpage.
51.05	Demonstrate the ability to transmit data in different formats (e.g., XML, JSON, alternatives to JavaScript).
51.06	Use AJAX to create form submission and validation (e.g. password strength check, email/URL validation).
51.07	Integrate a third party image gallery component.
52.0	Incorporate Canvas API methods into a webpage. – The student will be able to:
52.01	Use the HTML CANVAS tag to create a drawing area on a webpage.
52.02	Use JavaScript to write text on a canvas.
52.03	Use JavaScript to draw basic shapes (e.g., lines, circles, squares) on a canvas.
52.04	Use JavaScript and AJAX to draw charts and graphs on a canvas.
53.0	Demonstrate an understanding of PHP scripting. – The student will be able to:
53.01	Define the purpose of PHP and describe its importance in web design.
53.02	Discuss existing and emerging PHP versions.
53.03	Discuss various configuration options for installing PHP on a server.
54.0	Design, write, debug, and incorporate a PHP client-side script into a webpage. – The student will be able to:
54.01	Write, analyze and explain PHP syntax.
54.02	Describe usage of various data types.
54.03	Describe how the use of decision-making logic (e.g. and, or) is employed in a PHP program.
54.04	Create and use variables, operators and expressions.
54.05	Understand and incorporate PHP arrays (e.g., array basics, types, usage, methods, sorting).
54.06	Understand and incorporate PHP objects (e.g., creation, access).
54.07	Understand and incorporate PHP functions (e.g., pass a value, return value).
54.08	Understand and incorporate PHP loops and conditions (e.g., loop basics, types, usage).
54.09	Recognize, isolate, and correct common PHP errors (e.g., syntax, function errors, reserved word usage).

54.10	Apply PHP best coding practices (i.e., properly documenting scripts, field naming conventions, writing understandable code).
54.11	Troubleshoot and test incorporated script (i.e., functionality, browser usage, resolve known bugs).
55.0	Demonstrate an understanding of databases. – The student will be able to:
55.01	Define the purpose of a database and describe its importance in web design.
55.02	Define the purpose of SQL.
55.03	Discuss existing database management systems (e.g., MySQL, Oracle, SQL Server).
56.0	Incorporate a database into a webpage. – The student will be able to:
56.01	Create a database to store information for a website.
56.02	Understand how to use basic SQL commands (e.g., select, insert, update, delete) to manipulate the information in a database.
56.03	Execute SQL commands to manipulate the information in a database using a database management system.
56.04	Execute SQL commands to manipulate the information in a database using PHP.

**Course Number: CTS0016**  
**Occupational Completion Point: D**  
**Web E-commerce (Senior Web Designer) – 150 Hours – SOC Code 15-1199**

57.0 Demonstrate knowledge and skills necessary to setup a secure E-commerce site–The student will be able to:

57.01 Compare and contrast popular pre-built shopping cart software (e.g., PrestaShop, Zend Cart).

57.02 Compare and contrast hosting options available for use with shopping cart software (i.e., shared hosting or dedicated server).

57.03 Discuss shopping cart vulnerabilities and best-practice preventative measures.

57.04 Identify hardware and software necessary to install and setup pre-built shopping cart software.

57.05 Install and configure necessary software (database, server) to run pre-built shopping cart software.

57.06 Install and configure pre-built shopping cart software.

57.07 Verify database and server connectivity.

57.08 Test and troubleshoot setup/configuration issues.

58.0 Identify security issues associated with E-commerce and discuss methods to mitigate risks. – The student will be able to:

58.01 Describe the differences between Transaction Layer Security (TLS) and its predecessor, Secure Sockets Layer (SSL).

58.02 Explain transaction security.

58.03 Identify security and payment processing issues involved in developing a site (e.g., SSL, Digital Certificates, SET Protocol, Cyber Cash).

58.04 Demonstrate understanding of https and htaccess and their usage.

58.05 Explore methods to obtain an SSL certificate and secure transactions.

58.06 Compare and contrast the appropriateness of employing a merchant account or a payment gateway to handle online transactions.

58.07 Discuss the process, advantages, disadvantages, and costs associated with opening a merchant account.

58.08 Describe the process, advantages, disadvantages, and costs associated with using a payment gateway.

59.0 Apply skills necessary to setup an E-commerce storefront. – The student will be able to:

59.01 Setup and use an FTP (File Transfer Protocol) program to transfer files to a web server.

59.02 Add business specific information to site storefront (e.g., logos, product images, descriptions).

59.03 Setup back-end site administration functions and navigation.

59.04	Setup a schema for incorporating shipping, handling, and processing fees based on carrier, geographical zones, and weight/price range.
59.05	Experiment with various add-ons, themes, and modules available for customization.
59.06	Make simple modifications to a shopping cart to suit client needs (e.g., modify fields, add buttons).
59.07	Customize forms to accommodate client products and/or services.
59.08	Setup Search preferences and functionality for products and/or services.
59.09	Setup customer contact preferences and email notification functionality.
59.10	Apply Search Engine Optimization (SEO) techniques to shopping cart pages.
59.11	Test operation of shopping cart pages in multiple browsers.
59.12	Troubleshoot issues and errors related to browser display and functionality.
60.0	Employ techniques to enhance the value and profitability of an E-commerce website. – The student will be able to:
60.01	Determine business goals for the E-commerce site.
60.02	Identify the various types of advertising options in E-commerce (e.g., links, banner ads, affiliate programs, pop-up windows, viral marketing, newsgroup postings).
60.03	Describe affiliate marketing and its implications for E-commerce websites.
60.04	Analyze popular affiliate programs/networks and available payment schemes.
60.05	Explain the differences, advantages, and disadvantages of CPM, PPC, and Pay per Sale/Lead.
60.06	Determine appropriate affiliate program for target audience.
60.07	Identify the method to join an affiliate program/network.
60.08	Identify considerations/requirements of selecting an affiliate program.
60.09	Determine appropriate number of affiliate programs necessary to suit client site.
60.10	Determine the terms and conditions of sale, including warranties, after-sales service, and privacy assurances.
60.11	Determine customer service options (e.g., e-mail, phone, fax).
60.12	Create a site map.
60.13	Create a Frequently Asked Questions (FAQ) page.
60.14	Create a product/version comparison chart, where appropriate.

60.15	Create feedback, review, survey, and recommendation pages.
61.0	Develop evaluation and performance monitoring metrics and target goals for an E-commerce website. – The student will be able to:
61.01	Research existing and emerging analytical, usability, SEO tools to improve customer satisfaction and site conversion rates.
61.02	Describe web analytics tools and their features/functions.
61.03	Use web analytics tools to determine optimum site keywords.
61.04	Experiment with using advanced segments to view subsets of data (relating to purchasing habits, website usage, searches).
61.05	Customize analytic reports using appropriate metrics (e.g., average per-visit value, bounce rates, time spent on page).
61.06	Create more concise reports using advanced filters in web analytics tools.
61.07	Use intelligence features of web analytics tools to discover patterns of usage and setup corresponding alerts.
61.08	Research popular mobile analytics tools (e.g., Motally) and their features.
61.09	Interpret analytic report data and optimize website accordingly, if appropriate.

**Course Number: CTS0017**  
**Occupational Completion Point: D**  
**Web Interactivity (Senior Web Designer) – 150 Hours – SOC Code 15-1199**

62.0	Demonstrate an understanding of Content Management Systems (CMS) and their implications for web development. – The student will be able to:
62.01	Describe the fundamental operation of a CMS.
62.02	Describe the typical features of a content management system.
62.03	Compare and contrast popular CMS applications (e.g., WordPress, Joomla).
62.04	Describe how a content management system can be used to enhance website interactivity.
62.05	Demonstrate proficiency installing and configuring content management systems and extensions/modules.
63.0	Use CMS features, functions, and extensions/modules to create/enhance a website. – The student will be able to:
63.01	Create a basic multipage website using a content management system.
63.02	Enhance a webpage by using a content management system to incorporate images, animations, or video segments.
63.03	Incorporate a blog feature into a website using a content management system.
63.04	Demonstrate proficiency using CMS built-in security for website, password and database backup.
63.05	Demonstrate proficiency using add-on modules, or plug-ins.
64.0	Evaluate the suitability for and system requirements for a content management system. – The student will be able to:
64.01	Identify business goals and evaluate their suitability for a content management system.
64.02	Determine web hosting system requirements.
64.03	Create a schema for creating, deleting, and managing users and their permissions.
64.04	Discuss the value represented by templates in a content management system development environment.
65.0	Demonstrate an understanding of multimedia applications and their implications for web designers. – The student will be able to:
65.01	Compare and contrast the leading multimedia development applications for website development (e.g., Adobe Flash, Microsoft Silverlight).
65.02	Describe those circumstances whereby multimedia may be used to add interactivity to a website.
65.03	Describe the limitations of multimedia development applications relative to website development viewed on various platforms (e.g.,

PCs, tablets, mobile devices).

66.0 Create and incorporate interactive website components. – The student will be able to:

66.01 Create buttons, menus, and other components that feature a static, hover, and rollover effect.

66.02 Convert original artwork into an interactive component with associated script behavior.

66.03 Adjust the component properties including opacity, filter, rotation, and action.

66.04 Resize a multi-layer component to ensure uniform resizing of each layer.

66.05 Create scrolling images, panels, and lists for incorporating into a web design.

66.06 Create and incorporate animated banners, headers, and website introduction pages (e.g., Adobe Flash, Microsoft Silverlight).

67.0 PDF document usage considerations. – The student will be able to:

67.01 Discuss the advantages and disadvantages of using PDF documents in a website.

67.02 Research and discuss PDF document usage best practices.

67.03 Determine when it is appropriate to use PDF documents (e.g., brochure downloads, large reports, catalogs, interactive forms).

67.04 Compare and contrast the functionality of software applications used to create and process PDFs.

67.05 Research and describe search engine optimization considerations related to the use of PDF documents.

67.06 Research and discuss security issues related to PDF document usage in a website (viruses, auto-open).

67.07 Identify accessibility issues related to using PDF documents in a website.

68.0 Create, format, and manipulate PDF documents. – The student will be able to:

68.01 List & describe the methods available for creating PDF documents.

68.02 Create a PDF using a variety of software applications, multiple files, and webpages.

68.03 Demonstrate ability to format, modify and enhance a PDF document.

68.04 Describe the differences in PDF standards for document prepress data interchange and long-term archiving.

68.05 Embed images, text, audio, video, and Flash content into a PDF document.



68.06	Create and modify automatically generated and manual bookmarks in a PDF document.
68.07	Add clickable links to a PDF document.
68.08	Incorporate Find and Search methods to locate specific text in a PDF document.
68.09	Describe the method used to search scanned documents (optical character recognition).
68.10	Understand and correct color separation issues.
68.11	Create and modify PDF documents using available tools to meet accessibility requirements (e.g., tags, reading order, forms, supplemental content for multimedia, text-to-speech).
68.12	Export a PDF document in a different format.
69.0	Display, distribution, and print considerations for PDF documents. – The student will be able to:
69.01	Define file specifications use to generate smaller files for electronic distribution and on-screen display.
69.02	Specify image downsampling and compression settings to generate a PDF file with a smaller file size.
69.03	Identify and correct potential printing issues in a PDF document.
69.04	Ensure a PDF document meets appropriate criteria for print or electronic distribution.
69.05	Demonstrate ability to control flattening of a transparent PDF document and misregistration.
69.06	Demonstrate color management techniques that affect on-screen display and printing.
69.07	Discuss methods and tools used to review a PDF document (email, shared, tracking).
70.0	Create and manage PDF forms. – The student will be able to:
70.01	Create an interactive form using fields, form objects, and distribution methods.
70.02	Distribute a form electronically and manage distributed forms.
70.03	Demonstrate ability to redact content in a form to protect sensitive information.
70.04	Preview, test, and modify an interactive form.
71.0	Incorporate PDF security in a PDF document. – The student will be able to:
71.01	Secure a PDF document using passwords, encryption, digital IDs and signatures.
71.02	Creating Security Policies and Certificates for a PDF document.

71.03	Enable usage rights for Adobe Readers.
72.0	Demonstrate proficiency using HTML5 features and functions. – The student will be able to:
72.01	Apply HTML5 APIs in webpages for interactivity (e.g., audio/video, drag & drop, drawing canvas).
72.02	Apply HTML5 interactivity elements into webpages (i.e., <canvas>, <embed>, <audio>, <video>, <details> <input>).
72.03	Utilize HTML5 fallback strategies to address browser support issues.
72.04	Utilize HTML5 to define dynamic behaviors using JavaScript.
72.05	Use HTML5 specification to manipulate text and images.
72.06	Use HTML5 to create persistent data and single session storage (HTML 5 Local Offline Storage & Session Storage).
72.07	Use HTML5 for media event handling (audio, video, embed, image).
72.08	Use HTML5 event handling for window, mouse, and form events.
72.09	Use CSS3 to style HTML5 (e.g., transitions, typography enhancements).

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Java Development & Programming  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

Career Certificate Program	
Program Number	Y700200
CIP Number	0511020313
Grade Level	30, 31
Standard Length	1200 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA SkillsUSA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

### **Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating regular and specialized applications using the Java programming language, including testing, monitoring, debugging, documenting, and maintaining Java computer applications.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

## Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points, with OCPs A, B, and C.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2 COMPU SCI 6 COMP PROG 7G	300 hours	15-1131
C	CTS0044	Computer Programmer		150 hours	15-1131
D	CTS0031	Java Developer		600 hours	15-1131

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.
- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.



- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Construct statements that declare, initialize, and modify different types of variables used in Java programs.
- 37.0 Describe the types and characteristics of lexical units in the Java programming language.
- 38.0 Describe the data types employed in Java programs.
- 39.0 Construct Java statements that employ the use of various operators.
- 40.0 Write executable statements using Java.
- 41.0 Describe variable scope and its implications in Java programming.
- 42.0 Apply common Java programming style guidelines and conventions.
- 43.0 Demonstrate use of the compiler and interpreter through command line interface.
- 44.0 Construct conditional control statements in Java.
- 45.0 Construct iterative control statements in Java.
- 46.0 Use nested loop iterative control statements in Java.
- 47.0 Produce input and output for Java programs.
- 48.0 Use packages and import statements in a Java program.
- 49.0 Create a Java program that uses methods.
- 50.0 Create a Java program that uses parameters in methods.
- 51.0 Describe and use recursion in a Java program.
- 52.0 Construct Java statements that use the String class to manipulate String data.
- 53.0 Construct Java statements that use Classes.
- 54.0 Manage class relationships.
- 55.0 Construct Java statements that illustrate the use of multiplicities in class relationships.
- 56.0 Use object references.
- 57.0 Describe the types of arrays and construct Java statements that illustrate the use and manipulation of multi-dimensional and jagged arrays.
- 58.0 Construct Java statements that illustrate different ways of using inheritance.
- 59.0 Construct Java statements that use collections.
- 60.0 Write Java code that uses the Iterator and List interfaces.
- 61.0 Create Java code that includes exception handling code.
- 62.0 Create Java code that uses the Object class.
- 63.0 Use standard library classes that comprise the Java API.
- 64.0 Create Java code that uses exceptions to improve program quality.
- 65.0 Describe Java 2 Micro Edition (J2ME) uses, characteristics, and constraints.
- 66.0 Create and convert classes using Unified Modeling Language (UML).
- 67.0 Create programs that use of Remote Method Invocation (RMI) and other server technologies associated with Relational Database Management Systems (RDMS) and Structured Query Language (SQL).
- 68.0 Demonstrate an understanding of Java Integration APIs, including Java Message Service (JMS), Enterprise JavaBeans (EJB), and Java Naming and Directory Interface (JNDI).
- 69.0 Demonstrate an understanding of Java Client APIs, including the Abstract Window Toolkit (AWT), Swing, and Java applet.
- 70.0 Understand and apply Java 2 Enterprise Edition (J2EE) Server Solutions.
- 71.0 Create a database application using the Java programming language.

- 72.0 Create a graphical user interface application using the Java programming language.
- 73.0 Create a web-based application using the Java programming language.
- 74.0 Write code to perform common and union database queries using SQL and Java.
- 75.0 Implement Java program statements using objects.
- 76.0 Utilize debugging tools and write error handlers.
- 77.0 Demonstrate file I/O.
- 78.0 Utilize API functions.
- 79.0 Test and debug databases.
- 80.0 Successfully work as a member of a software development team.
- 81.0 Manage time according to a plan.
- 82.0 Keep acceptable records of progress, problems and solutions.
- 83.0 Plan, organize and carry out a project plan.
- 84.0 Manage resources.
- 85.0 Use tools, materials, and processes in an appropriate and safe manner.
- 86.0 Demonstrate an understanding of the software development process.
- 87.0 Research content related to the project and document the results.
- 88.0 Use presentation skills, and appropriate media to describe the progress, results and outcome of the experience.
- 89.0 Demonstrate competency in the area of expertise related to developing computer software using the Java programming language.

Florida Department of Education  
Student Performance Standards

Program Title: Java Development and Programming  
Career Certificate Program Number: Y700200

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

**Course Number: CTS0041**  
**Occupational Completion Point: B**  
**Computer Programmer Assistant – 300 Hours – SOC Code 15-1131**

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. – The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. – The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures–The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. – The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.

19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. – The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. – The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. – The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
23.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
23.02	Employ critical thinking and interpersonal skills to resolve conflicts.
23.03	Identify and document workplace performance goals and monitor progress toward those goals.
23.04	Conduct technical research to gather information necessary for decision-making.
23.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. – The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. – The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. – The student will be able to:

26.01	Choose appropriate data types depending on the needs of the program.
26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. – The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.



27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. – The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. – The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. – The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).
30.02	Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

**Course Number: CTS0044**  
**Occupational Completion Point: C**  
**Computer Programmer – 150 Hours – SOC Code 15-1131**

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. – The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. – The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. – The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.

33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. – The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.
35.0	Understand human interactions in intelligence. – The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.

35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.

**Course Number: CTS0031**  
**Occupational Completion Point: D**  
**Java Developer – 600 Hours – SOC Code 15-1131**

36.0 Construct statements that declare, initialize, and modify different types of variables used in Java programs. – The student will be able to:

36.01 Describe how variables are used in programs.

36.02 Identify the eight Java primitive data types.

36.03 Identify the minimum and maximum ranges of primitive data types.

36.04 Identify which data type should be used for a given situation.

36.05 Identify the syntax for using variables.

36.06 Declare and initialize variables.

36.07 Assign new values to variables.

36.08 Create and use constant variables.

37.0 Describe the types and characteristics of lexical units in the Java programming language. – The student will be able to:

37.01 Describe the types of lexical units.

37.02 Describe identifiers and identify valid and invalid identifiers.

37.03 Describe and identify reserved words, delimiters, literals, and comments.

38.0 Describe the data types employed in Java programs. – The student will be able to:

38.01 Describe the data type categories.

38.02 Give examples of primitives, reference data types.

38.03 Identify and use enumerations.

38.04 Understand the use of Wrapper Classes in programs.

38.05 Describe the difference between real and integer data types.

39.0 Construct Java statements that employ the use of various operators. – The student will be able to:

39.01 Construct statements using arithmetic operators.

39.02 Construct statements using relational operators.

39.03 Construct and use statements using logical operators.

39.04	Construct and use statements using assignment operators.
39.05	Construct and execute statements using operator precedence.
40.0	Write executable statements using Java. – The student will be able to:
40.01	Construct variable assignment statements.
40.02	Construct statements using built-in math functions.
40.03	Differentiate between implicit and explicit data type conversions.
40.04	Describe when implicit data type conversions take place.
40.05	List the drawbacks of implicit data type conversions.
40.06	Describe the process of autoboxing and promotion.
40.07	Construct statements using functions to explicitly convert data types.
41.0	Describe variable scope and its implications in Java programming. – The student will be able to:
41.01	Understand the scope and visibility of variables.
41.02	Write programs using local variables.
41.03	Describe the scope of a variable.
41.04	Describe the default value of local, instance, and static scope of variables.
41.05	Describe how compiler uses scope to identify variables with the same name.
42.0	Apply common Java programming style guidelines and conventions. – The student will be able to:
42.01	List examples of good programming practices.
42.02	Insert comments into code.
42.03	Follow formatting guidelines when writing code.
42.04	Understand the different types of errors produced by programs.
43.0	Demonstrate use of the compiler and interpreter through command line interface. – The student will be able to:
43.01	Describe the use of the Java compiler (javac) and Java interpreter (Java VM).
43.02	Demonstrate the use of the -classpath flag and -d flag to the compiler.
43.03	Identify the environmental variables of PATH and CLASSPATH.
43.04	Describe the process of command line arguments to the program.

43.05	Create programs that take in multiple command line arguments.
44.0	Construct conditional control statements in Java. – The student will be able to:
44.01	Construct and use an if statement.
44.02	Construct and use a switch statement.
44.03	Construct and use a while, do while, and for loop.
44.04	Construct and use a conditional operator.
45.0	Construct iterative control statements in Java. – The student will be able to:
45.01	Describe the types of loop statements and their uses.
45.02	Construct and use the while and do while loop.
45.03	Construct and use the for loop.
45.04	Construct and use the enhanced for loop.
45.05	Describe when a while loop is used.
45.06	Describe when a for loop is used.
46.0	Use nested loop iterative control statements in Java. – The student will be able to:
46.01	Construct and execute a program using nested loops.
46.02	Construct and execute a loop using break and continue.
46.03	Evaluate a nested loop construct and sentinel value.
47.0	Produce input and output for Java programs. – The student will be able to:
47.01	Describe and use classes (e.g., Scanner, System) to input data into programs.
47.02	Demonstrate the use of different ways to input data into programs using Scanner or System class.
47.03	Describe and demonstrate the use of the System class to produce output to the console.
47.04	Explain the difference between print and println functions in the System class.
47.05	Create and use escape sequences.
48.0	Use packages and import statements in a Java program. – The student will be able to:
48.01	Describe the use of import statements.
48.02	Describe the use of packages.



48.03	Create code that uses package statements to avoid class conflict.
48.04	Create packages that abide by standard Java naming convention.
48.05	Demonstrate the use of Java-API to search for classes and packages.
49.0	Create a Java program that uses methods. – The student will be able to:
49.01	Differentiate between anonymous blocks and methods.
49.02	Identify the benefits of using methods.
49.03	Describe a method signature.
49.04	Create a method.
49.05	Describe how a method is invoked.
49.06	Describe the purpose of overloading methods.
49.07	Create overloaded methods in programs.
50.0	Create a Java program that uses parameters in methods. – The student will be able to:
50.01	Describe how parameters are passed into functions.
50.02	Define a parameter.
50.03	Create a method using a parameter.
50.04	Invoke a method that has parameters.
50.05	Distinguish between formal and actual parameters.
50.06	Demonstrate the use of reference parameters in methods.
51.0	Describe and use recursion in a Java program. – The student will be able to:
51.01	Describe the use of recursion in solving problems.
51.02	Describe the difference of iterative and recursive methods.
51.03	Demonstrate the use of direct recursion.
51.04	Demonstrate the use of indirect recursion.
52.0	Construct Java statements that use the String class to manipulate String data. – The student will be able to:
52.01	Explain the use of the String class.

52.02	Create code to concatenate strings using the concatenation operator.
52.03	Demonstrate how to search a string using indexOf method of the String class.
52.04	Explain the effect of immutability of Strings.
52.05	Create Strings using string literals, and through new keyword.
52.06	Demonstrate the use of the following string manipulation methods of the String class: charAt,length, trim, substring, replace, startsWidth and endsWith.
53.0	Construct Java statements that use Classes. – The student will be able to:
53.01	Describe and identify abstract data types.
53.02	Describe the difference between an object and a class.
53.03	Identify class attributes.
53.04	Create instance variables for a class.
53.05	Use visibility modifiers for attributes.
53.06	Identify constructors and describe their use.
53.07	Describe encapsulation.
53.08	Write class using encapsulation.
53.09	Apply data abstraction through the use of accessor or and mutator methods.
53.10	Describe the equals method.
53.11	Demonstrate the use of classes in methods as both parameters and return types.
53.12	Describe the garbage collection process.
53.13	Demonstrate reusability and extensibility in class creation.
53.14	Demonstrate the use of Comparable interface to compare objects.
54.0	Manage class relationships. – The student will be able to:
54.01	Explain the association relationship among classes.
54.02	Explain the direct association relationship among classes.
54.03	Explain the composition and aggregation relationship among classes.
54.04	Explain the direct association relationship among classes.

54.05	Write programs that use composition, association.
54.06	Write programs that use direct association.
55.0	Construct Java statements that illustrate the use of multiplicities in class relationships. – The student will be able to:
55.01	Describe how multiplicities affect class relationships.
55.02	Describe one-to one, one-to-many, and many-to-many relationships.
55.03	Write programs that use multiplicities in class relationships.
56.0	Use object references. – The student will be able to:
56.01	Identify reference aliases.
56.02	Understand and use null reference.
56.03	Explain the this reference and its use in class creation.
57.0	Describe the types of arrays and construct Java statements that illustrate the use and manipulation of multi-dimensional and jagged arrays. – The student will be able to:
57.01	Declare and initialize an array.
57.02	Demonstrate the use of initializer lists.
57.03	Demonstrate the use of arrays in methods.
57.04	Demonstrate the updating, populating and destroying arrays.
57.05	Explain linear and binary searching.
57.06	Sort arrays using selection sort, insertion sort, and bubble sort.
57.07	Demonstrate the use of multidimensional arrays.
57.08	Demonstrate the use of jagged arrays.
57.09	Demonstrate basic hashing using arrays.
58.0	Construct Java statements that illustrate different ways of using inheritance. – The student will be able to:
58.01	Explain the purpose and use of inheritance in object oriented programming.
58.02	Explain the difference between single and multiple inheritance.
58.03	Create parent and child classes.
58.04	Create overloaded methods.

58.05	Describe the has-a and is-a relationship.
58.06	Create class hierarchies.
58.07	Explain the process of generalization to specification.
58.08	Demonstrate the use of abstract classes.
58.09	Explain polymorphism.
58.10	Create a program that uses polymorphism.
58.11	Demonstrate the use of the instanceof method.
59.0	Construct Java statements that use collections. – The student will be able to:
59.01	Describe data structure of linked lists.
59.02	Create a linked list manually.
59.03	Use the ArrayList class.
59.04	Create a stack and Queue manually.
59.05	Use the Stack and Queue standard class.
59.06	Identify which data structure is best fitted for a situation.
59.07	Use iterators with collections.
59.08	Identify how to insert, delete, update, and traverse data structures.
60.0	Write Java code that uses the Iterator and List interfaces. – The student will be able to:
60.01	Describe the purpose of interfaces.
60.02	Create and use interfaces in programs.
60.03	Use the Comparable interface.
60.04	Use the Iterator interface and List Interface in programs.
60.05	Understand the program to the interface principle.
61.0	Create Java code that includes exception handling code. – The student will be able to:
61.01	Describe the advantages of including exception handling code.

61.02	Describe the purpose of an EXCEPTION section in a program block.
61.03	Create code to include an EXCEPTION section.
61.04	List the guidelines for exception handling.
62.0	Create Java code that uses the Object class. – The student will be able to:
62.01	Understand the Object class relationship to other classes.
62.02	Demonstrate the use of toString method.
62.03	Demonstrate the use of clone and finalize methods.
62.04	Write program to use Object class functionality.
63.0	Use standard library classes that comprise the Java API. – The student will be able to:
63.01	Describe the classes and methods in the basic input/output package.
63.02	Describe the classes and methods in the utilities package.
63.03	Describe the classes and methods in the utilities package.
63.04	Describe the classes and methods in the networking package.
63.05	Describe the classes and methods in the AWT and swing package.
63.06	Describe the classes and methods in the SQL and SQLX package.
64.0	Create Java code that uses exceptions to improve program quality. – The student will be able to:
64.01	Explain how exception handling works in Java.
64.02	Trap exceptions using try and catch.
64.03	Explain when to use the finally clause.
64.04	Demonstrate handling exceptions through throwing and catching.
64.05	Create and Exception and manage the exception.
64.06	Explain the use of inheritance and exceptions.
65.0	Describe Java 2 Micro Edition (J2ME) uses, characteristics, and constraints. – The student will be able to:

65.01	Understand midlets.
65.02	Explain CLDC and profiles.
65.03	Explain the constraints specific to J2ME programming when compared to J2SE.
65.04	Understand the high architectural goal of J2ME.
65.05	Create user-defined functions.
66.0	Create and convert classes using Unified Modeling Language (UML). – The student will be able to:
66.01	Identify UML elements Classes, abstract Classes, Interfaces.
66.02	Identify UML attributes, operators, visibility modifiers and UML associations.
66.03	Given a set of classes be able to convert the classes to a UML diagram.
66.04	Given a UML diagram be able to create classes.
67.0	Create programs that use of Remote Method Invocation (RMI) and other server technologies associated with Relational Database Management Systems (RDMS) and Structured Query Language (SQL). – The student will be able to:
67.01	Understand and describe RMI.
67.02	Write a program to use RMI.
67.03	Understand RDMS and SQL technologies.
67.04	Use the Java Database Connectivity API to connect and execute SQL statements to RDMS.
68.0	Demonstrate an understanding of Java Integration APIs, including Java Message Service (JMS), Enterprise JavaBeans (EJB), and Java Naming and Directory Interface (JNDI). – The student will be able to:
68.01	Understand and describe JMS.
68.02	Understand and describe EJB technology.
68.03	Understand and describe JNDI technology.
69.0	Demonstrate an understanding of Java Client APIs, including the Abstract Window Toolkit (AWT), Swing, and Java applet. – The student will be able to:
69.01	Understand and describe AWT and GUI interface.
69.02	Understand and describe the use of Swing components and GUI.
69.03	Understand and describe the use of applet technology.

70.0	Understand and apply Java 2 Enterprise Edition (J2EE) Server Solutions. – The student will be able to:
70.01	Understand java Web Services.
70.02	Underrated and use SMTP and Java Mail technologies.
70.03	Understand how to use JSP and Servlets.
71.0	Create a database application using the Java programming language. – The student will be able to:
71.01	Utilize loop statements.
71.02	Given a scenario, use arithmetic, comparison, and pattern-matching operators.
71.03	Create user-defined functions.
71.04	Utilize common built-in functions.
71.05	Declare variables in modules and procedures.
71.06	Declare arrays, and initialize elements of arrays.
71.07	Declare and use object variables and collections, and use their associated properties and methods.
71.08	Declare symbolic constants, and make them available locally or publicly.
71.09	Respond to events.
72.0	Create a graphical user interface application using the Java programming language. – The student will be able to:
72.01	Utilize loop statements.
72.02	Given a scenario, use arithmetic, comparison, and pattern-matching operators.
72.03	Create user-defined functions.
72.04	Utilize common built-in functions.
72.05	Declare variables in modules and procedures.
72.06	Declare arrays, and initialize elements of arrays.
72.07	Declare and use object variables and collections, and use their associated properties and methods.
72.08	Declare symbolic constants, and make them available locally or publicly.
72.09	Use the Java Event model to handle user inputs from events.

72.10	Use JComponents and layout managers to create the GUI.
73.0	Create a web-based application using the Java programming language. – The student will be able to:
73.01	Utilize loop statements.
73.02	Given a scenario, use arithmetic, comparison, and pattern-matching operators.
73.03	Create user-defined functions.
73.04	Utilize common built-in functions.
73.05	Declare variables in modules and procedures.
73.06	Declare arrays, and initialize elements of arrays.
73.07	Declare and use object variables and collections, and use their associated properties and methods.
73.08	Declare symbolic constants, and make them available locally or publicly.
73.09	Write JSP pages to process user input.
73.10	Write Servlets to provide input and output processing for the web solution.
74.0	Write code to perform common and union database queries using SQL and Java. – The student will be able to:
74.01	Utilize SQL to write common queries.
74.02	Refer to objects by using SQL.
74.03	Utilize union queries.
75.0	Implement Java program statements using objects. – The student will be able to:
75.01	Determine when to use data access objects.
75.02	Differentiate between objects and collections.
75.03	Write statements that access and modify database objects, EJB objects.
75.04	Select appropriate methods and property settings for use with specified objects.
76.0	Utilize debugging tools and write error handlers. – The student will be able to:
76.01	Trap errors.
76.02	Utilize debugging tools to suspend program execution, and to examine, step through, and reset execution of code.



76.03	Debug code samples.
76.04	Utilize the Debugger to monitor variable values.
76.05	Write an error handler.
77.0	Demonstrate file input/output (I/O). – The student will be able to:
77.01	Read from sequential and random access files.
77.02	Write to sequential and random access files.
77.03	Use file serialization.
78.0	Utilize API functions. – The student will be able to:
78.01	Properly declare functions.
78.02	Use the by value and by reference parameters.
79.0	Test and debug databases. – The student will be able to:
79.01	Implement error handling.
79.02	Test and debug library databases.
80.0	Successfully work as a member of a software development team. – The student will be able to:
80.01	Accept responsibility for specific tasks in a given situation.
80.02	Document progress, and provide feedback on work accomplished in a timely manner.
80.03	Complete assigned tasks in a timely and professional manner.
80.04	Reassign responsibilities when the need arises.
80.05	Complete daily tasks as assigned on one's own initiative.
81.0	Manage time according to a plan. – The student will be able to:
81.01	Set realistic time frames and schedules.
81.02	Keep a written time sheet of work accomplished on a daily basis.
81.03	Meet goals and objectives set by the team.
81.04	Identify individual priorities.
81.05	Complete a weekly evaluation of accomplishments, and reevaluate goals, objectives and priorities as needed.

82.0	Keep acceptable records of progress problems and solutions. – The student will be able to:
82.01	Develop a record keeping system in the form of a log book to record daily progress.
82.02	Use a project journal to identify problem statement.
82.03	Develop a portfolio of work accomplished to include design drawings, flowcharts, drawings and plans, and prototypes.
83.0	Plan, organize, and carry out a project plan. – The student will be able to:
83.01	Determine the scope of a project.
83.02	Organize the team according to individual strengths.
83.03	Assign specific tasks within a team.
83.04	Determine project priorities.
83.05	Identify required resources.
83.06	Plan research, design, development, and evaluation activities as required.
83.07	Carry out the project plan to successful completion.
84.0	Manage resources. – The student will be able to:
84.01	Identify required resources for each stage of the project plan.
84.02	Determine the methods needed to acquire needed resources.
84.03	Demonstrate good judgment in the use of resources.
84.04	Recycle and reuse resources where appropriate.
84.05	Demonstrate an understanding of proper legal and ethical treatment of copyrighted material.
85.0	Use tools, materials, and processes in an appropriate and safe manner. – The student will be able to:
85.01	Identify the proper tool for a given job.
85.02	Use tools and machines in a safe manner.
85.03	Adhere to laboratory or job site safety rules and procedures.
85.04	Identify the application of processes appropriate to the task at hand.
85.05	Identify materials appropriate to their application.

86.0	Demonstrate an understanding of the software development process. – The student will be able to:
86.01	State the goals of the software application clearly.
86.02	Identify and write a plan to achieve each goal.
86.03	Develop a list of materials and content required for each goal.
86.04	Develop a step by step procedure for developing the application.
86.05	Follow a written procedure.
86.06	Record data from evaluation activities.
86.07	Document conclusions and solutions based on evaluation results, observations and data.
86.08	Document progress using a project log.
86.09	Write an abstract describing the project plan.
87.0	Research content related to the project and document the results following industry conventions. – The student will be able to:
87.01	Identify the basic research needed to develop the project plan.
87.02	Identify available resources for completing background research required in the project plan.
87.03	Demonstrate the ability to locate resource materials in a library, data base, internet and other research resources.
87.04	Demonstrate the ability to organize information retrieval.
87.05	Demonstrate the ability to prepare a topic outline.
87.06	Write a draft of the research report.
87.07	Edit and proof the research report. Use proper form for a bibliography, footnotes, quotations, and references.
87.08	Prepare an electronically composed research paper in proper form.
87.09	Conduct an alpha and beta evaluation of the project's product.
87.10	Write a report on the evaluations, documenting results, data, observations, and design changes based on the results.
88.0	Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience. – The student will be able to:
88.01	Prepare a multi-media presentation on the completed project.
88.02	Make an oral presentation, using multi-media materials.

88.03	Review the presentation, and make changes in the delivery method(s) to improve presentation skills.
89.0	Demonstrate competency in the area of expertise related to developing computer software using the Java programming language. – The student will be able to:
89.01	Demonstrate a mastery of the content of the selected subject area.
89.02	Demonstrate the ability to use related technological tools, materials and processes related to the specific program area.
89.03	Demonstrate the ability to apply the knowledge, experience and skill developed in the previous program completion to the successful completion of this demonstration.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Database Application Development & Programming  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y700300
CIP Number	0511020315
Grade Level	30, 31
Standard Length	1200 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA SkillsUSA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating regular and specialized applications using standard and extended Structured Query Language (SQL), including testing, monitoring, debugging, documenting, and maintaining database applications.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

## Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points, with OCPs A, B, and C.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2 COMPU SCI 6 COMP PROG 7G	300 hours	15-1131
C	CTS0044	Computer Programmer		150 hours	15-1131
D	CTS0062	Database Programmer		600 hours	15-1131



## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.
- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.

- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Develop an awareness of the changes taking place in the information age and how they fit into an evolving society.
- 37.0 Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs.
- 38.0 Develop the process of creating an entity by identifying relationships.
- 39.0 Formulate and assemble initial entity relationship by expanding on modeling concepts.
- 40.0 Consider the degree and optionality of relationships of entities.
- 41.0 Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams.
- 42.0 Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships.
- 43.0 Demonstrate proficiency in designing and adding complexity to an entity-relationship model (ERM).
- 44.0 Apply complex ERM information by fine-tuning entities and the process for relating them.
- 45.0 Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved.
- 46.0 Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion or mistakes.
- 47.0 Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data.
- 48.0 Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database.
- 49.0 Extend the logical model presentation model by normalizing the data and mapping the management system.
- 50.0 Apply techniques for building a storage management system by creating a website using templates and wizards.
- 51.0 Demonstrate design and functionality by constructing a group business presentation.
- 52.0 Demonstrate comprehension of database modeling competency through group presentation.
- 53.0 Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints.
- 54.0 Demonstrate comprehension of aspects of SQL language interface by writing basic SQL statements.
- 55.0 Demonstrate proficiency working with columns, characters, and rows in SQL.
- 56.0 Demonstrate proficiency in using SQL comparison operators.
- 57.0 Demonstrate proficiency in using logical comparisons and precedence rules.
- 58.0 Demonstrate proficiency using SQL single row functions.
- 59.0 Demonstrate proficiency displaying data from multiple tables.
- 60.0 Demonstrate proficiency aggregating data using group functions.
- 61.0 Demonstrate proficiency utilizing subqueries.
- 62.0 Demonstrate proficiency producing readable output with SQL language interface, reporting tool, and data manipulation language.
- 63.0 Demonstrate proficiency creating and managing database objects.
- 64.0 Demonstrate proficiency altering tables and constraints implementing views.
- 65.0 Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects.
- 66.0 Demonstrate ability to control user access and SQL language interface and reporting tool.
- 67.0 Demonstrate comprehension of bundling features of SQL.
- 68.0 Demonstrate comprehension working with composite data types by writing executable script files.
- 69.0 Describe the differences between SQL and SQL extension languages.

- 70.0 Create program blocks.
- 71.0 Use variables in program blocks.
- 72.0 Recognize lexical units.
- 73.0 Recognize data types.
- 74.0 Use scalar data types.
- 75.0 Use various types of joins.
- 76.0 Use SQL group functions and subqueries.
- 77.0 Write executable statements.
- 78.0 Use nested blocks and variable scope.
- 79.0 Use good programming practices.
- 80.0 Write DML statements to manipulate data.
- 81.0 Retrieve data.
- 82.0 Manipulate data.
- 83.0 Use transaction control statements
- 84.0 Use IF conditional control statements.
- 85.0 Use CASE conditional control statements.
- 86.0 Use basic LOOP iterative control statements.
- 87.0 Use WHILE and FOR loop iterative control statements.
- 88.0 Use nested loop iterative control statements.
- 89.0 Use explicit cursors.
- 90.0 Use explicit cursor attributes.
- 91.0 Use cursor FOR loops.
- 92.0 Use cursors with parameters.
- 93.0 Use cursors for update transactions.
- 94.0 Use multiple cursors.
- 95.0 Handle exceptions.
- 96.0 Trap server exceptions.
- 97.0 Trap user-defined exceptions.
- 98.0 Create procedures.
- 99.0 Use parameters in procedures.
- 100.0 Pass parameters.
- 101.0 Create stored functions.
- 102.0 Use functions in SQL statements.
- 103.0 Manage procedures and functions.
- 104.0 Manage object privileges.
- 105.0 Use invoker's rights.
- 106.0 Create packages.
- 107.0 Manage package constructs.
- 108.0 Use advanced package concepts.
- 109.0 Manage persistent state of package variables.
- 110.0 Use vendor-supplied packages.
- 111.0 Understand dynamic SQL.

- 112.0 Understand triggers.
- 113.0 Create DML triggers.
- 114.0 Create DDL and database event triggers.
- 115.0 Manage triggers.
- 116.0 Use large object data types.
- 117.0 Manage binary types.
- 118.0 Manage indexes.
- 119.0 Manage dependencies.
- 120.0 Demonstrate an understanding of Agile Development.
- 121.0 Program a database application.
- 122.0 Utilize the basic concepts of database design.
- 123.0 Utilize SQL and union queries.
- 124.0 Implement program statements using objects.
- 125.0 Utilize debugging tools and write error handlers.
- 126.0 Demonstrate file I/O.
- 127.0 Create forms and identify all the properties of a form.
- 128.0 Manipulate data using object models.
- 129.0 Develop custom controls.
- 130.0 Utilize API functions.
- 131.0 Demonstrate and implement database replication using programming tools.
- 132.0 Analyze and implement security options.
- 133.0 Implement client/server applications.
- 134.0 Optimize the performance of a database.
- 135.0 Perform application distribution.
- 136.0 Test and debug databases.
- 137.0 Describe the difference between relational and NoSQL databases.
- 138.0 Demonstrate an understanding of Data Science and the concept of Data mining.

Florida Department of Education  
Student Performance Standards

Program Title: Database Application Development & Programming  
Career Certificate Program Number: Y700300

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

**Course Number: CTS0041**  
**Occupational Completion Point: B**  
**Computer Programmer Assistant – 300 Hours – SOC Code 15-1131**

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. – The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. – The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures–The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. – The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.



19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. – The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. – The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. – The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
23.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
23.02	Employ critical thinking and interpersonal skills to resolve conflicts.
23.03	Identify and document workplace performance goals and monitor progress toward those goals.
23.04	Conduct technical research to gather information necessary for decision-making.
23.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. – The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. – The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. – The student will be able to:

26.01	Choose appropriate data types depending on the needs of the program.
26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. – The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.

27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. – The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. – The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. – The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).
30.02	Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

**Course Number: CTS0044**  
**Occupational Completion Point: C**  
**Computer Programmer – 150 Hours – SOC Code 15-1131**

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. – The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. – The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. – The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.

33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. – The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.

35.0	Understand human interactions in intelligence. – The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.
35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.



**Course Number: CTS0062**  
**Occupational Completion Point: D**  
**Database Programmer – 600 Hours – SOC Code 15-1131**

36.0	Develop an awareness of the changes taking place in the information age and how they fit into an evolving society. – The student will be able to:
36.01	Cite examples of jobs, salary, and opportunities he/she will have as a database programmer.
36.02	Describe the role a database plays in a business.
36.03	Understand the importance of clear communication when discussing business informational requirements.
36.04	Identify important historical contributions in database development and design.
37.0	Develop the "big picture" of database design and how to best organize data according to business rules and/or client needs. – The student will be able to:
37.01	Identify and analyze the phases of the database development process.
37.02	Explain what logical data modeling and database design involve.
37.03	Compare database development process with that of the application development process.
37.04	Distinguish between a logical model and a physical implementation.
38.0	Develop the process of creating an entity by identifying relationships. – The student will be able to:
38.01	Identify and model various types of entities.
38.02	Identify naming and drawing conventions for entities.
38.03	Sequence the steps that are necessary for creation of an entity.
38.04	Analyze and model the relationships between entities.
39.0	Formulate and assemble initial entity relationship by expanding on modeling concepts. – The student will be able to:
39.01	Analyze and model attributes.
39.02	Identify unique identifiers for each entity.
39.03	Develop an entity relationship diagram tagging attributes with optionality.
40.0	Consider the degree and optionality of relationships of entities. – The student will be able to:
40.01	Create entity relationship models based on information requirements and interviews.
40.02	Differentiate between one-to-many, many-to-many and one-to-one relationships.
40.03	Identify relationship between two entities by reading a given diagram.

	40.04 Create a relationship between instances of the same entity.
	40.05 Read an entity relationship model in order to validate it.
41.0	Demonstrate proficiency in early construction stages of the data modeling process by using unique identifiers and many-to-many (M:M) relationships for building entity relationship diagrams. – The student will be able to:
	41.01 Identify the significance of an attribute that has more than one value for each entity instance.
	41.02 Evaluate appropriate methods of storing validation rules for attributes.
	41.03 Recognize unique identifiers inherited from other entities.
	41.04 Sequence the steps involved in resolving a many-to-many relationship.
42.0	Demonstrate proficiency in advanced data constructs by analyzing business requirements and diagramming entities and relationships. – The student will be able to:
	42.01 Validate that an attribute is properly placed based upon its dependence on its entity's unique identifier (UID).
	42.02 Resolve many-to-many relationships with intersection entities.
	42.03 Model advanced data constructs including recursive relationships, subtypes, and exclusive relationships.
	42.04 Create exclusive entities and relationships by using subtypes and arcs, respectively.
	42.05 Identify initial layout for presentation and generate a list of action items for members of group.
	42.06 Develop an entity relationship model using subtypes, super-types and an exclusive arc.
43.0	Demonstrate proficiency in designing and adding complexity to a logical model. – The student will be able to:
	43.01 Revise an entity relationship model according to client requirements.
	43.02 Define and give examples of hierarchical and recursive relationships.
	43.03 Differentiate between transferable and non-transferable relationships.
	43.04 Deliver a professional, formal business style presentation.
	43.05 Evaluate and critique presentation layout, design and performance.
	43.06 Construct a model using both recursion and hierarchies to express the same logical meaning.
44.0	Apply complex logical information by fine-tuning entities and the process for relating them. – The student will be able to:
	44.01 Describe a relational database and how it differs from other database systems.
	44.02 Define primary keys and foreign keys and describe their purpose.
	44.03 Describe what data integrity refers to and list some constraints.

44.04	Explain how database design fits into the database development process.
44.05	Translate a logical model into a relational database design.
45.0	Apply initial database design and normalization by following the set of house rules that determine how items are stored and retrieved. – The student will be able to:
45.01	Demonstrate ability to implement steps for mapping entity relationship models for implementation.
45.02	Document an initial database design on table instance charts.
45.03	Recognize raw data and evaluate the steps for creating a data group in unnormalized form.
46.0	Demonstrate proficiency in the technique of normalization by labeling and organizing all items in a database in such a way as to prevent any confusion or mistakes. – The student will be able to:
46.01	Differentiate between normalized and unnormalized data.
46.02	Move data from an unnormalized form through to a third normal form.
46.03	Demonstrate ability to test data groups for third normal form compliance.
46.04	Identify optimized data groups from given groups of normalized data.
47.0	Demonstrate proficiency in table normalization by combining the techniques of an entity relationship model or a top-down, business approach to data with normalization or a bottom-up mathematical approach to data. – The student will be able to:
47.01	Compare the normalization and logical techniques in terms of strengths and weaknesses.
47.02	Further define normalization and explain its benefits.
47.03	Place tables in third normal form.
47.04	Explain how logical data modeling rules ensure normalized tables.
47.05	Specify referential integrity constraints and design indices.
48.0	Apply blueprint principles to begin designing a tool for creating a web-based interface access to a database. – The student will be able to:
48.01	Evaluate the transformation of business requirements into an initial layout and design for a database.
48.02	Construct simple webpage design for personal work folder.
48.03	Evaluate existing websites and determine quality of design.
49.0	Extend the logical model presentation model by normalizing the data and mapping the management system. – The student will be able to:
49.01	Formulate a plan of action for the Database Project using skills previously learned in this course.
49.02	Normalize a logical model to the third normal form (3NF).
49.03	Create a table in the database using a database authoring tool.

49.04	Demonstrate ability to edit tables using a database authoring tool.
49.05	Create forms that will display the table components created with a database authoring tool.
50.0	Apply techniques for building a storage management system by creating a website using templates and wizards. – The student will be able to:
50.01	Create a website that displays the database project home.
50.02	Link a website to create a web-enabled interface to the industry database.
50.03	Edit the forms created and specify appropriate field labels for data entry.
51.0	Demonstrate design and functionality by constructing a group business presentation. – The student will be able to:
51.01	Evaluate and generate criteria for a formal, business presentation.
51.02	Construct a persuasive group presentation using the guidelines set forth in class.
52.0	Demonstrate comprehension of database modeling competency through group presentation. – The student will be able to:
52.01	Deliver a formal business presentation for the class that discusses a logical model and initial database design.
52.02	Demonstrate the functionality of the database and the layout/design capabilities of a database authoring tool.
52.03	Prepare appropriate end-user documentation.
52.04	Self-assess learning experience through the presentation and demonstration of their final database project.
53.0	Demonstrate comprehension that the database management software is a system for organizing the storage unit (or database) according to business needs and rules, through data integrity constraints. – The student will be able to:
53.01	Identify the structural elements of a relational database table.
53.02	List and describe the system development life cycle.
53.03	Describe the industry implementation of the relational database management system (RDBMS) and object relational database management system (ORDBMS).
53.04	Explain how SQL and languages that extend SQL are used in the industry product set.
53.05	Identify the advantages of a database management system.
54.0	Demonstrate comprehension of aspects of SQL language interface by writing basic SQL statements. – The student will be able to:
54.01	List the capabilities of SQL SELECT statements.
54.02	Execute a basic SELECT statement.
54.03	Differentiate between SQL statements and language commands that extend SQL.

55.0	Demonstrate proficiency working with columns, characters, and rows in SQL. – The student will be able to:
55.01	Apply the concatenation operator to link columns to other columns, arithmetic expressions, or constant values to create a character expression.
55.02	Use column aliases to rename columns in the query result.
55.03	Eliminate duplicate rows in the query result.
55.04	Display the structure of a table.
55.05	Apply SQL syntax to restrict the rows returned from a query.
55.06	Demonstrate application of the WHERE clause syntax.
55.07	Construct and produce output using a SQL query containing character strings and date values.
56.0	Demonstrate proficiency in using SQL comparison operators. – The student will be able to:
56.01	Apply the proper comparison operator to return a desired result.
56.02	Demonstrate proper use of BETWEEN, IN, and LIKE conditions to return a desired result.
56.03	Distinguish between zero and the value of NULL as unavailable, unassigned, unknown, or inapplicable.
56.04	Explain the use of comparison conditions and NULL.
57.0	Demonstrate proficiency in using logical comparisons and precedence rules. – The student will be able to:
57.01	Evaluate logical comparisons to restrict the rows returned based on two or more conditions.
57.02	Apply the rules of precedence to determine the order in which expressions are evaluated and calculated.
57.03	Construct a query to order a results set for single or multiple columns.
57.04	Construct a query to sort a results set in ascending or descending order.
58.0	Demonstrate proficiency using SQL single row functions. – The student will be able to:
58.01	Perform calculations on data.
58.02	Modify individual data items.
58.03	Use character, number and date functions in SELECT statements.
58.04	Format data and numbers for display purposes.
58.05	Convert column data types.
59.0	Demonstrate proficiency displaying data from multiple tables. – The student will be able to:

59.01	Construct SELECT statements to access data from more than one table using equity and non-equality joins.
59.02	Use outer joins through viewing data that generally does not meet a join condition.
59.03	Join a table to itself.
60.0	Demonstrate proficiency aggregating data using group functions. – The student will be able to:
60.01	Identify the available group functions and describe their use.
60.02	Demonstrate the ability to group data through the use of the GROUP BY clause.
60.03	Demonstrate the ability to include or exclude grouped rows by using the HAVING clause.
61.0	Demonstrate proficiency utilizing subqueries. – The student will be able to:
61.01	Write a query with an embedded subquery.
61.02	Evaluate and perform a multiple-column subquery.
61.03	Describe and explain the behavior of subqueries when NULL values are retrieved.
61.04	Create a subquery in a FROM clause.
62.0	Demonstrate proficiency producing readable output with SQL language interface, reporting tool, and data manipulation language. – The student will be able to:
62.01	Produce queries that require an input variable.
62.02	Customize the SQL language interface and reporting environment using SET commands for control.
62.03	Produce more readable output through the use of the column and break commands.
62.04	Describe data manipulation language (DML) and describe various DML statements.
62.05	Utilize data manipulation language (DML) through inserting, updating and deleting rows from a table.
62.06	Control transactions using COMMIT and ROLLBACK statements.
63.0	Demonstrate proficiency creating and managing database objects. – The student will be able to:
63.01	Describe the main database objects.
63.02	Create tables and alter their definitions.
63.03	Describe the data types that can be used when specifying column definition.
64.0	Demonstrate proficiency altering tables and constraints implementing views. – The student will be able to:
64.01	Create, drop, rename and truncate tables using SQL.

64.02	Identify and describe various constraints including not NULL, unique, primary key, foreign key, and check.
64.03	Create and maintain constraints including adding, dropping, enabling, disabling, and cascading.
64.04	Recognize views and explain how they are created, how they retrieve data and how they perform DML operations.
65.0	Demonstrate mastery of creating and implementing views, synonyms, indexes and other database objects. – The student will be able to:
65.01	Create views, retrieve data through a view, alter the definition of a view and drop a view.
65.02	Categorize information by using Top-N queries to retrieve specified data.
65.03	Identify the features of a sequence and display sequence values using a data dictionary view.
65.04	Identify the characteristics of a cached sequence.
65.05	Modify and remove a sequence using a SQL statement.
65.06	Identify the features of private and public synonyms.
65.07	Identify characteristics of an index and describe different types.
65.08	Create and remove an index using a SQL statement.
66.0	Demonstrate ability to control user access and SQL language interface and reporting tool. – The student will be able to:
66.01	Identify the features of database security.
66.02	Create users using SQL statements.
66.03	Grant and revoke object privileges using a SQL language interface and reporting tool.
67.0	Demonstrate comprehension of bundling features of SQL. – The student will be able to:
67.01	List and describe the benefits of extension languages to SQL.
67.02	Recognize the basic SQL block and its sections.
67.03	Declare SQL variables and describe their significance.
67.04	Execute a SQL block.
68.0	Demonstrate comprehension working with composite data types by writing executable script files. – The student will be able to:
68.01	Recognize the significance of the executable section and decide when to use it.
68.02	Write statements in the executable section.
68.03	Describe the rules of nested blocks.

68.04	Identify and utilize appropriate coding conventions.
68.05	Create a script that will insert, update, merge and delete data in a table.
69.0	Describe the differences between SQL and SQL extension languages. – The student will be able to:
69.01	Describe SQL extension languages.
69.02	Differentiate between SQL and SQL extension languages.
69.03	Explain the need for and benefits of SQL extension languages.
70.0	Create program blocks. – The student will be able to:
70.01	Describe the structure of a program block.
70.02	Identify the different types of program blocks.
70.03	Identify program programming environments.
70.04	Create and execute an anonymous block.
70.05	Output messages in program blocks.
71.0	Use variables in program blocks. – The student will be able to:
71.01	Describe how variables are used in program blocks.
71.02	Identify the syntax for using variables.
71.03	Declare and initialize variables.
71.04	Assign new values to variables.
72.0	Recognize lexical units. – The student will be able to:
72.01	Describe the types of lexical units.
72.02	Describe identifiers and identify valid and invalid identifiers.
72.03	Describe and identify reserved words, delimiters, literals, and comments.
73.0	Recognize data types. – The student will be able to:
73.01	Describe the data type categories.
73.02	Give examples of scalar, composite, and large object (LOB) data types.
73.03	Identify when an object becomes eligible for garbage collection.



74.0	Use scalar data types. – The student will be able to:
74.01	Declare and use scalar data types.
74.02	Define guidelines for declaring and initializing variables.
75.0	Use various types of joins. – The student will be able to:
75.01	Construct and execute SELECT statements using an equijoin.
75.02	Construct and execute SELECT statements using a non-equijoin.
75.03	Construct and execute SELECT statements using an outer join.
75.04	Construct and execute SELECT statements that result in cross join.
76.0	Use SQL group functions and subqueries. – The student will be able to:
76.01	Construct and execute an SQL query using group functions to determine a sum total, an average amount, and a maximum value.
76.02	Construct and execute an SQL query that groups data based on specified criteria.
76.03	Construct and execute an SQL query that contains a WHERE clause using a single-row subquery.
76.04	Construct and execute an SQL query that contains a WHERE clause using a multiple-row subquery.
77.0	Write executable statements. – The student will be able to:
77.01	Construct variable assignment statements.
77.02	Construct statements using built-in SQL functions.
77.03	Differentiate between implicit and explicit data type conversions.
77.04	Describe when implicit data type conversions take place.
77.05	List the drawbacks of implicit data type conversions.
77.06	Construct statements using functions to explicitly convert data types.
77.07	Construct statements using operators.
78.0	Use nested blocks and variable scope. – The student will be able to:
78.01	Understand the scope and visibility of variables.
78.02	Write nested blocks and qualify variables with labels.
78.03	Describe the scope of an exception.

78.04	Describe the effect of exception propagation in nested blocks.
79.0	Use good programming practices. – The student will be able to:
79.01	List examples of good programming practices.
79.02	Insert comments into code.
79.03	Follow formatting guidelines when writing code.
80.0	Write DML statements to manipulate data. – The student will be able to:
80.01	Construct and execute a statement to insert data into a table.
80.02	Construct and execute a statement to update data in a table.
80.03	Construct and execute a statement to delete data from a table.
80.04	Construct and execute a statement to merge data into a table.
81.0	Retrieve data. – The student will be able to:
81.01	Identify SQL statements that can be directly included in an executable block.
81.02	Construct and execute an INTO clause to hold values returned by a single-row SELECT statement.
81.03	Construct statements that retrieve data.
82.0	Manipulate data. – The student will be able to:
82.01	Describe when to use implicit or explicit cursors.
82.02	Create code to use SQL implicit cursor attributes to evaluate cursor activity.
83.0	Use transaction control statements. – The student will be able to:
83.01	Define a transaction and give an example.
83.02	Construct and execute a transaction control statement.
84.0	Use IF conditional control statements. – The student will be able to:
84.01	Construct and use an IF statement.
84.02	Construct and use an IF -ELSIF statement.
84.03	Create control statements to handle NULL conditions in an IF statement.
85.0	Use CASE conditional control statements. – The student will be able to:

85.01	Construct and use CASE statements.
85.02	Construct and use CASE expressions.
85.03	Include syntax to handle NULL conditions in a CASE statement.
85.04	Include syntax to handle Boolean conditions in IF and CASE statements.
86.0	Use basic LOOP iterative control statements. – The student will be able to:
86.01	Describe the types of LOOP statements and their uses.
86.02	Create a program containing a basic loop and an EXIT statement.
86.03	Create a program containing a basic loop and an EXIT statement with conditional termination.
87.0	Use WHILE and FOR loop iterative control statements. – The student will be able to:
87.01	Construct and use the WHILE looping construct.
87.02	Construct and use the FOR looping construct.
87.03	Describe when a WHILE loop is used.
87.04	Describe when a FOR loop is used.
88.0	Use nested loop iterative control statements–The student will be able to:
88.01	Construct and execute a program using nested loops.
88.02	Evaluate a nested loop construct and identify the exit point.
89.0	Use explicit cursors. – The student will be able to:
89.01	List the guidelines for declaring and controlling explicit cursors.
89.02	Create code to open a cursor and fetch a piece of data into a variable.
89.03	Use a simple loop to fetch multiple rows from a cursor.
89.04	Create code to close a cursor.
90.0	Use explicit cursor attributes. – The student will be able to:
90.01	Define a record structure.
90.02	Create code to process the row of an active set using record types in cursors.
90.03	Use cursor attributes to retrieve information about the state of an explicit cursor.

91.0	Use cursor FOR loops. – The student will be able to:
91.01	List and explain the benefits of using a cursor FOR loops.
91.02	Create code to declare a cursor and manipulate it in a FOR loop.
91.03	Create code containing a cursor FOR loop using a subquery.
92.0	Use cursors with parameters. – The student will be able to:
92.01	List the benefits of using parameters with cursors.
92.02	Create code to declare and manipulate a cursor with a parameter.
93.0	Use cursors for update transactions. – The student will be able to:
93.01	Create code to lock rows before an update using the appropriate clause.
93.02	Explain the effect of using NOWAIT in an update cursor declaration.
93.03	Create code to use the current row of the cursor in an UPDATE or DELETE statement.
94.0	Use multiple cursors. – The student will be able to:
94.01	Explain the need for using multiple cursors to produce multilevel reports.
94.02	Create code to declare and manipulate multiple cursors within nested loops.
94.03	Create code to declare and manipulate multiple cursors using parameters.
95.0	Handle exceptions. – The student will be able to:
95.01	Describe the advantages of including exception handling code.
95.02	Describe the purpose of an EXCEPTION section in a program block.
95.03	Create code to include an EXCEPTION section.
95.04	List the guidelines for exception handling.
96.0	Trap server exceptions. – The student will be able to:
96.01	Distinguish between errors defined by the server and those defined by the programmer.
96.02	Differentiate between errors that are handled implicitly and explicitly by the server.
96.03	Write code to trap a predefined server error.
96.04	Write code to trap a non-predefined server error.

96.05	Write code to identify an exception by error code and by error message.
97.0	Trap user-defined exceptions. – The student will be able to:
97.01	Write code to name a user-defined exception.
97.02	Write code to raise an exception.
97.03	Write code to handle a raised exception.
98.0	Create procedures. – The student will be able to:
98.01	Differentiate between anonymous blocks and subprograms.
98.02	Identify the benefits of using subprograms.
98.03	Describe a stored procedure.
98.04	Create a procedure.
98.05	Describe how a stored procedure is invoked.
99.0	Use parameters in procedures. – The student will be able to:
99.01	Describe how parameters contribute to a procedure.
99.02	Define a parameter.
99.03	Create a procedure using a parameter.
99.04	Invoke a procedure that has parameters.
99.05	Distinguish between formal and actual parameters.
100.0	Pass parameters. – The student will be able to:
100.01	List the types of parameter modes.
100.02	Create a procedure that passes parameters.
100.03	Identify methods for passing parameters.
100.04	Describe the default option for parameters.
101.0	Create stored functions. – The student will be able to:
101.01	Describe the difference between a stored procedure and a stored function.

101.02	Create a program block containing a function.
101.03	Identify ways in which functions may be invoked.
101.04	Create a program block that invokes a function that has parameters.
102.0	Use functions in SQL statements. – The student will be able to:
102.01	Describe where user-defined functions can be called from within an SQL statement.
102.02	Describe the restrictions on calling functions from SQL statements.
102.03	Describe the purpose of the Data Dictionary.
102.04	Differentiate different types of Data Dictionary views.
102.05	Write SQL SELECT statements to retrieve information from the Data Dictionary.
103.0	Manage procedures and functions. – The student will be able to:
103.01	Describe how exceptions are propagated.
103.02	Remove a function and a procedure.
103.03	Use Data Dictionary views to identify and manage stored procedures.
104.0	Manage object privileges. – The student will be able to:
104.01	List and explain several object privileges.
104.02	Explain the function of the EXECUTE object privilege.
104.03	Write SQL statements to grant and revoke object privileges.
105.0	Use invoker's rights. – The student will be able to:
105.01	Contrast invoker's rights with definer's rights.
105.02	Create a procedure that uses invoker's rights.
106.0	Create packages. – The student will be able to:
106.01	Describe a package, its components, and the reasons for use.
106.02	Create packages containing related variables, cursors, constants, exceptions, procedures, and functions.
106.03	Create a program block that invokes a package construct.

107.0	Manage package constructs. – The student will be able to:
107.01	Explain the difference between public and private package constructs.
107.02	Designate a package construct as either public or private.
107.03	Specify the syntax to drop a package.
107.04	Identify Data Dictionary views used to manage packages.
107.05	Identify the guidelines for using packages.
108.0	Use advanced package concepts. – The student will be able to:
108.01	Write packages that use the overloading feature.
108.02	Write packages that use forward declarations.
108.03	Explain the purpose of a package initialization block.
108.04	Identify restrictions on using packaged functions in SQL statements.
109.0	Manage persistent state of package variables. – The student will be able to:
109.01	Identify persistent states of package variables.
109.02	Control the persistent state of a package cursor.
110.0	Use vendor-supplied packages. – The student will be able to:
110.01	Describe common uses for vendor-supplied packages.
110.02	Use the syntax to specify messages for a vendor-supplied package.
110.03	Identify the exceptions used in conjunction with vendor-supplied packages.
111.0	Understand dynamic SQL. – The student will be able to:
111.01	Identify the stages through which all SQL statements pass.
111.02	Describe the reasons for using dynamic SQL to create an SQL statement.
111.03	List statements supporting Native Dynamic SQL.
112.0	Understand triggers. – The student will be able to:
112.01	Describe database triggers and their uses.
112.02	Differentiate between a database trigger and an application trigger.

112.03	List the guidelines for using triggers.
112.04	Compare and contrast database triggers and stored procedures.
113.0	Create DML triggers. – The student will be able to:
113.01	Create a DML trigger and identify its components.
113.02	Create a statement level trigger.
113.03	Describe the trigger firing sequence options.
113.04	Create a DML trigger that uses conditional predicates.
113.05	Create a row level trigger.
113.06	Create a row level trigger that uses OLD and NEW qualifiers.
113.07	Create an INSTEAD OF trigger.
114.0	Create DDL and database event triggers. – The student will be able to:
114.01	Describe the events that cause DDL and database event triggers to fire.
114.02	Create a trigger for a DDL statement.
114.03	Create a trigger for a database event.
114.04	Describe the functionality of the CALL statement.
114.05	Describe the cause of a mutating table.
115.0	Manage triggers. – The student will be able to:
115.01	View trigger information in the Data Dictionary.
115.02	Disable and enable a database trigger.
115.03	Remove a trigger from the database.
116.0	Use large object data types. – The student will be able to:
116.01	Compare and contrast LONG and LOB data types.
116.02	Describe LOB data types and how they are used.
116.03	Differentiate between internal and external LOBs.
116.04	Create and maintain LOB data types.



116.05 Migrate data from LONG to LOB.
<b>117.0 Manage binary types. – The student will be able to:</b>
117.01 Define binary column data type.
117.02 Create directory objects and view them in the Data Dictionary.
117.03 Manage and manipulate binary types.
<b>118.0 Manage indexes. – The student will be able to:</b>
118.01 Create and manipulate user-defined records.
118.02 Create an index.
118.03 Describe the difference between records, tables, and indexes.
<b>119.0 Manage dependencies. – The student will be able to:</b>
119.01 Describe the implications of procedural dependencies.
119.02 Contrast dependent objects and referenced objects.
119.03 View dependency information in the Data Dictionary.
119.04 Use a script to create the objects required to display dependencies.
119.05 Use views to display dependencies.
119.06 Describe how to minimize dependency failures.
<b>120.0 Demonstrate an understanding of Agile Development. – The student will be able to:</b>
120.01 Compare Agile project development to the waterfall approach.
120.02 Describe the Agile manifesto and the 12 principles.
120.03 Describe the benefits of Agile development.
<b>121.0 Program a database application. – The student will be able to:</b>
121.01 Utilize loop statements.
121.02 Given a scenario, use arithmetic, comparison, and pattern-matching operators.
121.03 Create user-defined functions.
121.04 Utilize common built-in functions.

121.05	Declare variables in modules and procedures.
121.06	Declare arrays, and initialize elements of arrays.
121.07	Declare and use object variables and collections, and use their associated properties and methods.
121.08	Declare symbolic constants, and make them available locally or publicly.
121.09	Respond to events.
122.0	Utilize the basic concepts of database design. – The student will be able to:
122.01	Apply basic concepts of normalization.
122.02	Utilize the cascade update and cascade delete options.
123.0	Utilize SQL and union queries. – The student will be able to:
123.01	Utilize SQL to write common queries.
123.02	Refer to objects by using SQL.
123.03	Utilize union queries.
124.0	Implement program statements using objects. – The student will be able to:
124.01	Determine when to use data access objects.
124.02	Differentiate between objects and collections.
124.03	Write statements that access and modify database objects.
124.04	Utilize data access objects.
124.05	Select appropriate methods and property settings for use with specified objects.
125.0	Utilize debugging tools and write error handlers. – The student will be able to:
125.01	Trap errors.
125.02	Utilize debugging tools to suspend program execution, and to examine, step through, and reset execution of code.
125.03	Debug code samples.
125.04	Utilize the Debugger to monitor variable values.
125.05	Write an error handler.
126.0	Demonstrate file I/O. – The student will be able to:

126.01	Read from files.
126.02	Write to files.
126.03	Utilize record locking.
127.0	Create forms and identify all the properties of a form. – The student will be able to:
127.01	Choose form-specific and report-specific properties to set.
127.02	Choose control properties to set.
127.03	Assign event-handling procedures to controls in a form.
127.04	Define and create form and report modules.
127.05	Identify the scope of a form or report module.
127.06	Open multiple instances of a form, and refer to them.
127.07	Assign values to form properties.
127.08	Use form methods.
128.0	Manipulate data using object models. – The student will be able to:
128.01	Connect to a data source.
128.02	Open a recordset.
128.03	Insert, update, merge and delete data.
129.0	Develop custom controls. – The student will be able to:
129.01	Set properties for custom controls.
129.02	Customize user interface controls.
130.0	Utilize API functions. – The student will be able to:
130.01	Properly declare functions.
130.02	Use the by value and by reference parameters.
131.0	Demonstrate and implement database replication using programming tools. – The student will be able to:
131.01	Make a database replicable.
131.02	View a synchronization schedule.

131.03	Explain how synchronization conflicts are resolved.
131.04	Identify the advantages of using replication of synchronization.
131.05	Identify the changes that the database engine makes when it converts a nonreplicable database into replicable database.
132.0	Analyze and implement security options. – The student will be able to:
132.01	Analyze a scenario, and recommend an appropriate type of security.
132.02	Explain the steps for implementing security.
132.03	Analyze code to ensure that it sets security options.
132.04	Write code to implement security options.
133.0	Implement client/server applications. – The student will be able to:
133.01	Demonstrate SQL pass through queries and application queries.
133.02	Access external data.
133.03	Trap errors that are generated by the server.
133.04	Optimize connections.
133.05	Optimize performance for a given client/server application.
134.0	Optimize the performance of a database. – The student will be able to:
134.01	Differentiate between single-field and multiple-field indexes.
134.02	Optimize queries.
134.03	Restructure queries to allow faster execution.
134.04	Optimize performance in distributed applications.
134.05	Optimize performance for client/server applications.
135.0	Perform application distribution. – The student will be able to:
135.01	Prepare an application for distribution.
135.02	Analyze various methods to distribute a client/server application.
135.03	Distribute custom controls with an application.
135.04	Provide online help.

136.0	Test and debug databases. – The student will be able to:
136.01	Implement error handling.
136.02	Test and debug library databases.
137.0	Describe the difference between relational and NoSQL databases. – The student will be able to:
137.01	Describe the advantages and disadvantages of NoSQL databases.
137.02	Describe the types of NoSQL databases (e.g., key-value store, column-based, graph-based, document-based).
137.03	Describe when a NoSQL database should be used for storage.
138.0	Demonstrate an understanding of Data Science and the concept of Data mining. – The student will be able to:
138.01	Define Data Science.
138.02	Define Data Mining.
138.03	Describe and compare Structured Data and Non-Structured Data.
138.04	Describe and model the Data Science Life Cycle.
138.05	Describe and compare various Deep Learning Frameworks available to Data Science.
138.06	Describe and compare Data Science and Data Analytics.

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In a Career Certificate Program offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** .NET Application Development & Programming  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y700400
CIP Number	0511020314
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating .NET-based applications, including testing, monitoring, debugging, documenting, and maintaining .NET applications.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.



## Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points, with OCPs A, B, and C.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2 COMPU SCI 6 COMP PROG 7G	300 hours	15-1131
C	CTS0044	Computer Programmer		150 hours	15-1131
D	CTS0032	.NET Programmer		450 hours	15-1131

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.
- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.

- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Develop an awareness of the changes taking place in the information age and how they fit into an evolving society.
- 37.0 Understand .NET primitive data types and their uses.
- 38.0 Describe the types and characteristics of lexical units in the .NET programming language.
- 39.0 Construct statements that use various .NET operators.
- 40.0 Construct and use .NET selection control structures.
- 41.0 Construct and use .NET iterative control structures.
- 42.0 Construct and use .NET structures for error handling.
- 43.0 Write .NET programs that define and use user-defined data types, including classes.
- 44.0 Write .NET programs that define and use methods.
- 45.0 Write programs that perform console input and output in a .NET program.
- 46.0 Use namespaces in a .NET program.
- 47.0 Use arrays in .NET programs.
- 48.0 Write .NET programs that use the object-oriented concept of inheritance.
- 49.0 Write .NET programs that use the object-oriented concept of polymorphism.
- 50.0 Write .NET programs that use the object-oriented concept of encapsulation.
- 51.0 Apply common programming style guidelines and conventions.
- 52.0 Use application life cycle management to develop and maintain .NET programs.
- 53.0 Use nullable values in a .NET program.
- 54.0 Use the .NET String and StringBuilder classes in an application.
- 55.0 Use .NET classes to perform stream input/output.
- 56.0 Use recursive functions to solve problems in .NET programs.
- 57.0 Write .NET programs that use interfaces.
- 58.0 Use .NET collections in applications.
- 59.0 Demonstrate knowledge of different types of .NET applications.
- 60.0 Demonstrate knowledge of .NET architecture and tools.
- 61.0 Demonstrate knowledge of web applications.
- 62.0 Develop webpages using HTML, CSS, JavaScript, and ASP.NET.
- 63.0 Develop .NET Windows Form applications.
- 64.0 Develop Windows Service applications and class libraries.
- 65.0 Demonstrate knowledge of database applications.
- 66.0 Demonstrate knowledge of structured query language (SQL) statements.
- 67.0 Develop .NET database applications.
- 68.0 Successfully work as a member of a software development team.
- 69.0 Manage time according to a plan.
- 70.0 Keep acceptable records of progress problems and solutions.
- 71.0 Plan, organize, and carry out a project plan.
- 72.0 Manage resources.
- 73.0 Use tools, materials, and processes in an appropriate and safe manner.

- 74.0 Demonstrate an understanding of the software development process.
- 75.0 Research content related to the project and document the results following industry conventions.
- 76.0 Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience.
- 77.0 Demonstrate competency in the area of expertise related to developing computer software using the .NET framework.

Florida Department of Education  
Student Performance Standards

Program Title: .NET Application Development & Programming  
Career Certificate Program Number: Y700400

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.

**Course Number: CTS0041**  
**Occupational Completion Point: B**  
**Computer Programmer Assistant – 300 Hours – SOC Code 15-1131**

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. – The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. – The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures–The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. – The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.



19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. – The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. – The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. – The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
26.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
26.02	Employ critical thinking and interpersonal skills to resolve conflicts.
26.03	Identify and document workplace performance goals and monitor progress toward those goals.
26.04	Conduct technical research to gather information necessary for decision-making.
26.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. – The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. – The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. – The student will be able to:

26.01	Choose appropriate data types depending on the needs of the program.
26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. – The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.

27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. – The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. – The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. – The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).
30.02	Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

**Course Number: CTS0044**  
**Occupational Completion Point: C**  
**Computer Programmer – 150 Hours – SOC Code 15-1131**

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. – The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. – The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. – The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.

33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. – The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.
35.0	Understand human interactions in intelligence. – The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.

35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.



**Course Number: CTS0032**  
**Occupational Completion Point: D**  
**.NET Programmer – 450 Hours – SOC Code 15-1131**

36.0 Develop an awareness of the changes taking place in the information age and how they fit into an evolving society. – The student will be able to:

36.01 Cite examples of jobs, salary, and opportunities he/she will have as a .NET programmer.

36.02 Describe the role a database plays in a business.

36.03 Explain the value of middleware, such as the .NET framework, in developing software applications.

36.04 Understand the importance of clear communication when discussing business informational requirements.

37.0 Understand .NET primitive data types and their uses. – The student will be able to:

37.01 Describe how variables are used in programs.

37.02 Identify the .NET built-in value types, their uses, and the ranges of values supported by each type.

37.03 Identify the default values for built-in value types.

37.04 Write statements that declare and initialize variables.

37.05 Write statements that assign literal values to numeric types.

37.06 Identify the .NET built-in reference types.

37.07 Write statements that assign string literals to string types.

37.08 Explain the memory size requirements for the various data storage types.

37.09 Identify which types are stored on the heap and which are stored on the stack.

37.10 Identify which data type should be used for a given purpose in a program.

37.11 Write statements that create variables with values that cannot be changed (i.e., const, final).

37.12 Identify the syntax for declaring and initializing each of the built-in data types.

37.13 Differentiate between implicit and explicit data type conversions.

37.14 Describe when implicit data type conversions take place.

37.15 Write statements that use explicit type conversion.

37.16 List the drawbacks of implicit data type conversions.

37.17	Compare and contrast boxing and unboxing.
37.18	Describe the scope of a variable.
37.19	Describe how the compiler uses scope to distinguish between variables with the same name.
38.0	Describe the types and characteristics of lexical units in the .NET programming language. – The student will be able to:
38.01	Describe the types of lexical units (e.g., keywords, directives, operators).
38.02	Describe identifiers and identify valid and invalid identifiers.
38.03	Describe and identify reserved words, delimiters, literals, and comments.
39.0	Construct statements that use various .NET operators. – The student will be able to:
39.01	Construct statements using arithmetic operators.
39.02	Construct statements using relational operators.
39.03	Construct and use statements using logical operators.
39.04	Construct and use statements using assignment operators.
39.05	Construct and execute statements using operator precedence.
39.06	Construct and execute statements using methods and fields of the math class.
40.0	Construct and use .NET selection control structures. – The student will be able to:
40.01	Construct and use an if structure in a program.
40.02	Construct and use an if/else structure in a program.
40.03	Construct and use multiple-selection structures (e.g., switch, elseif, select) in programs.
40.04	Construct and use nested selection structures in a program.
40.05	Construct and use a conditional operator.
41.0	Construct and use .NET iterative control structures. – The student will be able to:
41.01	Describe the types of iterative control structures and their uses.
41.02	Construct and use a while structures (e.g., while, do/while, do/until) in a program.
41.03	Construct and use a for structure in a program.
41.04	Construct and use a control structure that iterates over each item in a collection (e.g., foreach, for/each/next).

41.05	Describe the limits and advantages of different iterative control structure (i.e., while, do/while, for, foreach or for/each).
41.06	Construct and use nested structures (iterative and selective) in a program.
41.07	Write programs that alter the execution of program loops (e.g., break, continue, exit).
42.0	Construct and use .NET structures for error handling. – The student will be able to:
42.01	Describe the different types of software errors.
42.02	Compare and contrast alternatives for handling errors.
42.03	Write programs that validate user input and handle errors.
42.04	Explain the correct method for using multiple catch blocks for exceptions.
42.05	Explain the purpose of the finally block in exception handling.
42.06	Write programs that handle exceptions using the try/catch/finally structure.
42.07	Write programs with nested exception handling.
42.08	Explain the concept of structured exception handling.
42.09	Identify common exceptions and their causes.
42.10	Explain the concept of throwing a new exception.
42.11	Write programs that catch and re-throw exceptions.
42.12	Write exception handlers that use characteristics of the exception argument in the program.
43.0	Write .NET programs that define and use user-defined data types, including classes. – The student will be able to:
43.01	Explain the concept of a user-defined data type.
43.02	Distinguish between structures and classes.
43.03	Identify the syntax for declaring enumerations and structures.
43.04	Write programs that use declare and use enumerations.
43.05	Write programs that declare and use structures.
43.06	Explain the characteristics of different class constructs including instance variables, properties, fields, methods, events, object references, and constructors.
43.07	Write programs that declare and use classes.

43.08	Distinguish between different types of classes, including base class, derived class, abstract class, and sealed class.
43.09	Explain the impact of using different access modifiers on user-defined data types.
43.10	Use access modifiers in a program to control visibility to variables and user-defined data types.
43.11	Explain the this reference and its uses.
44.0	Write .NET programs that define and use methods. – The student will be able to:
44.01	Identify the benefits of using methods.
44.02	Describe the different types of class methods and their purposes.
44.03	Create class methods that do and do not return values.
44.04	Write statements that invoke a method.
44.05	Create a method using arguments.
44.06	Invoke a method that has arguments.
44.07	Describe a method signature.
44.08	Describe the purpose of overloading methods.
44.09	Write programs that have overloaded methods.
44.10	Define methods that have default arguments.
44.11	Describe the conflict between overloaded methods and default arguments.
44.12	Explain the impact of using different access modifiers on class methods.
44.13	Write methods that use argument modifiers (e.g., out, ref, byref, byval, const).
45.0	Write programs that perform console input and output in a .NET program. – The student will be able to:
45.01	Use the Console class to read and write data from the console.
45.02	Write statements that use escape sequences.
45.03	Write statements that format string and numeric output.
45.04	Write statements that use the ToString method to output data.
46.0	Use namespaces in a .NET program. – The student will be able to:

46.01	Compare and contrast assemblies and namespaces.
46.02	Describe the use of namespaces in .NET programming.
46.03	Describe commonly used .NET namespaces (e.g., System, System.IO, System.Collections, System.Drawing).
46.04	Identify the correct namespace to include for specified classes.
46.05	Write programs that define a namespace.
46.06	Create namespaces that abide by standard naming convention.
47.0	Use arrays in .NET programs. – The student will be able to:
47.01	Write statements to declare and initialize an array.
47.02	Demonstrate the use of initializer lists.
47.03	Write methods that take an array as an argument.
47.04	Write methods that return an array to the calling method.
47.05	Write statements to update, and destroy arrays.
47.06	Explain linear and binary searching.
47.07	Use the static methods of the Array class to perform searches, binary searches, and sorts.
47.08	Demonstrate the use of multidimensional arrays.
47.09	Demonstrate the use of jagged arrays (array of arrays).
48.0	Write .NET programs that use the object-oriented concept of inheritance. – The student will be able to:
48.01	Explain the purpose and use of inheritance in object oriented programming.
48.02	Compare and contrast single and multiple inheritance.
48.03	Explain the purpose and implementation of classes that cannot serve as a base class (a sealed class).
48.04	Describe has-a and is-a relationships.
48.05	Create class hierarchies using inheritance.
48.06	Declare and use a class derived from another class (implementing an is-a relationship).
48.07	Declare and use a class where the derived class overrides methods of the base class.

48.08	Declare and use a class that contains another class as a data member (implementing a has-a relationship).
48.09	Write statements that determine at run time whether an instance of a class is derived from a specific base class or interface.
48.10	Write statements that invoke a method of the base class from a derived class.
48.11	Identify which class methods can be inherited and which cannot.
48.12	Explain how access modifiers affect the inheritance of class variables and methods.
49.0	Write .NET programs that use the object-oriented concept of polymorphism. – The student will be able to:
49.01	Explain the purpose and implementation of classes that cannot be instantiated (an abstract class).
49.02	Explain the purpose and implementation of virtual class methods that must be overridden by derived classes.
49.03	Explain the use of abstract classes in enforcing polymorphism.
49.04	Create an abstract class.
49.05	Create classes that derive from an abstract class.
49.06	Create a program that uses polymorphism.
50.0	Write .NET programs that use the object-oriented concept of encapsulation. – The student will be able to:
50.01	Define and use classes that use access modifiers (e.g., private, public, protected, internal, internal protected) to provide encapsulation of data.
50.02	Explain the restrictions on using accessibility levels.
50.03	Compare and contrast different types of variable scope, including block, procedure, module/class, and project scope.
50.04	Compare and contrast different types of method scope, including public, private, protected, friend, and protectedfriend.
50.05	Write programs that use local variables.
50.06	Describe the scope of a given variable.
50.07	Describe how the compiler uses scope to distinguish between variables with the same name.
50.08	Explain the purpose and use of static classes, variables and methods.
50.09	Write programs that create and use static classes, variables, and methods.
51.0	Apply common programming style guidelines and conventions. – The student will be able to:

51.01	List examples of good programming practices.
51.02	Insert comments into code.
51.03	Follow formatting guidelines when writing code.
51.04	Define guidelines for declaring and initializing variables.
52.0	Use application life cycle management to develop and maintain .NET programs. – The student will be able to:
52.01	Describe the stages in the life cycle of an application.
52.02	Describe tools used to manage each stage in the life cycle of an application and how each is used to ensure the integrity of the product.
52.03	Describe how the needs of the customer affect the development of an application.
52.04	Describe the different types of testing that are performed on an application.
52.05	Describe the role of tools such as UML (Unified Modeling Language) in ensuring the integrity of the application.
52.06	Describe different types of UML diagrams and guidelines for their use.
52.07	Develop a class based on its description in a UML diagram.
52.08	Read an application specification and translate it into a working program.
52.09	Describe the characteristics of different types of application development (e.g., Agile development).
52.10	Compare and contrast different methodologies for application development (e.g., Scrum, XP, Crystal, FDD, and DSDM).
52.11	Describe different methods for deploying applications.
53.0	Use nullable values in a .NET program. – The student will be able to:
53.01	Describe the use of nullable value types.
53.02	Describe the use of the null value in .NET programs.
53.03	Write statements to declare and initialize nullable value types.
53.04	Write statements to determine if a nullable value type currently has a value.
54.0	Use the .NET String and StringBuilder classes in an application. – The student will be able to:
54.01	Compare and contrast the String and StringBuilder classes.
54.02	Identify the performance implications of using the String and StringBuilder classes for different purposes.
54.03	Use the methods of the String class to compare, search, format, split and join strings.

54.04	Use the methods of the String and StringBuilder classes to find, replace, delete, and insert substrings.
54.05	Use the methods of the String class to translate a string into uppercase or lowercase.
54.06	Use culture information to modify strings.
55.0	Use .NET classes to perform stream input/output. – The student will be able to:
55.01	Compare and contrast .NET classes used to perform file input/output (e.g., StreamReader, StreamWriter, StringReader, StringWriter, MemoryStream, BinaryReader, BinaryWriter).
55.02	Compare and contrast .NET classes used to manipulate files and directories (e.g., Directory, DirectoryInfo, File, FileInfo, Path).
55.03	Use .NET classes to search, add, and delete directories.
55.04	Use .NET classes to search, add, and delete files.
55.05	Use .NET classes to read and write text to a file.
55.06	Use .NET classes to read and write objects of a variety of types to a file.
55.07	Use .NET classes to read and write binary data to a file.
55.08	Compare and contrast .NET classes used to compress data (e.g., GZipStream, DeflateStream).
55.09	Use .NET classes to read and write compressed data to a file.
56.0	Use recursive functions to solve problems in .NET programs. – The student will be able to:
56.01	Describe the use of recursive methods in solving problems.
56.02	Describe the difference of iterative and recursive methods.
56.03	Demonstrate the use of direct recursion.
56.04	Demonstrate the use of indirect recursion.
57.0	Write .NET programs that use interfaces. – The student will be able to:
57.01	Describe interfaces and their use in .NET programming.
57.02	Declare and use a class that implements a standard interface.
57.03	Compare and contrast inheritance from a base class and inheritance of an interface.
57.04	Identify common interfaces and their purposes (e.g., IComparable, IComparer, IEquatable, IDisposable, IFormattable, IConvertible).
57.05	Define and use a custom interface.



57.06	Write classes that implement common interfaces (e.g., IComparable, IComparer, IEquatable, IDisposable, IFormattable, IConvertible).
57.07	Describe the program to interface principle and its benefits.
58.0	Use .NET collections in applications. – The student will be able to:
58.01	Compare and contrast common non-generic collection classes, including ArrayList, BitArray, HashTable, Queue, and Stack.
58.02	Write programs that use common non-generic collection classes.
58.03	Compare and contrast non-generic collection classes to generic collection classes.
58.04	Compare and contrast common generic collection classes, including Dictionary, LinkedList, Queue, SortedDictionary, SortedList, and Stack.
58.05	Write programs that use common generic collection classes.
58.06	Identify the collection class that is the best choice for different application requirements.
58.07	Use iterators to access individual members of different types of collections.
58.08	Use standard methods to add, delete, and modify members of different types of collections.
58.09	Write statements to access members of a dictionary based on a key.
58.10	Write statements to determine the existence of members of a dictionary based on a key or a value.
59.0	Demonstrate knowledge of different types of .NET applications. – The student will be able to:
59.01	Compare and contrast different types of .NET applications (e.g., Console, Windows Form, WPF, Windows Service, Class Library, web, and database).
59.02	Choose the best type of application to develop for a given application scenario.
59.03	Describe the characteristics and capabilities of a console application.
59.04	Develop, test, and debug a console application.
59.05	Write a console application that uses command-line arguments.
60.0	Demonstrate knowledge of .NET architecture and tools. – The student will be able to:
60.01	Describe components of the .NET architecture, including the Common Language Runtime (CLR), just-in-time (JIT) compiler, intermediate language (IL).
60.02	Describe the steps required for a managed assembly to be built and run in the .NET environment.
60.03	Compile single-file and multi-file assemblies using command-line tools.

60.04	Describe common command-line tools used in developing .NET applications (e.g., Al.exe, Caspol.exe, Ildasm.exe, Makecert.exe, Sn.exe, Gacutil.ext) and their purposes.
60.05	Use a signing tool to sign an assembly.
60.06	Use a disassembly tool to view the classes, members, and methods of an assembly.
60.07	Describe the garbage collection process.
61.0	Demonstrate knowledge of web applications. – The student will be able to:
61.01	Describe the web as a platform for applications.
61.02	Compare and contrast static and dynamic content.
61.03	Describe how webpages are loaded to a computer from the Internet including the hardware, software, servers, and protocols required.
61.04	Compare and contrast server-side and client-side programming.
61.05	Describe how a web browser downloads and renders a webpage.
61.06	Describe options and methodology for website deployment.
61.07	Compare and contrast different web development technologies, including HTML, CSS, JavaScript, CGI scripts, XML, and ASP.NET.
61.08	Describe common webpage terminology (e.g., page life cycle, the webpage event model, webpage state management, cookies, virtual directories).
61.09	Define the steps in the page life cycle of an ASP.NET webpage.
61.10	Describe state management as it related to maintenance of page information.
61.11	Describe how web services are accessed from a client application.
61.12	Describe thePostBack mechanism for posting data to a webpage using ASP.NET.
61.13	Describe the role of Internet Information Services (IIS).
61.14	Describe the role of Internet Service Providers (ISP) and the services they provide.
61.15	Describe web services and related tools (e.g., Extensible Markup Language (XML), Simple Object Access Protocol (SOAP) and Web Service Definition Language (WSDL)).
61.16	Describe the characteristics and purposes of Application objects and Session objects that are maintained by the ASP.NET run-time engine.
61.17	Describe the common ASP.NET events for applications and sessions (i.e., application start, application end, application error, session start, session end).
61.18	Describe entities that define standards for Internet applications (e.g., WS3, OASIS, WS-I).
62.0	Develop webpages using HTML, CSS, JavaScript, and ASP.NET. – The student will be able to:

62.01	Describe the characteristics and capabilities of a web application.
62.02	Develop webpages using HTML (Hyper-text Markup Language) that include commonly used tags to define webpages with hyperlinks, tables, text, headings, images, backgrounds, and frames.
62.03	Develop webpages using CSS (cascading style sheets) to define a uniform appearance across multiple webpages.
62.04	Develop webpages using JavaScript to define and implement interactive content.
62.05	Define and use functions in JavaScript.
62.06	Define and use local and global variables using JavaScript.
62.07	Use conditional operators in JavaScript to selectively perform specific function.
62.08	Use Boolean conditions in JavaScript to selectively perform with multiple conditions.
62.09	Use JavaScript loops to perform iteration.
62.10	Use string objects and escape sequences in a JavaScript.
62.11	Use JavaScript to access, use, and modify HTML elements.
62.12	Use JavaScript to handle common events, including mouse events, key events, and page events.
62.13	Use JavaScript to create and manage forms within a webpage.
62.14	Develop webpages that use ASP.NET to provide interactivity.
62.15	Describe standards for making webpages accessible to individuals with disabilities.
62.16	Develop webpages that conform to accessibility standards.
63.0	Develop .NET Windows Form applications. – The student will be able to:
63.01	Describe the characteristics and capabilities of a Windows Forms application.
63.02	Compare and contrast common objects used in Windows Forms applications (e.g., Button, CheckBox, ColorDialog, ComboBox, DateTimePicker, GroupBox, Label, LinkLabel, ListBox, MenuStrip, Panel, PictureBox, RadioButton, ToolTip).
63.03	Develop an interactive Windows Forms application that uses a variety of objects for input and output.
63.04	Perform data validation on input fields.
63.05	Describe the Windows Forms event model.
63.06	Create Windows Forms application that respond to common events, including mouse events, keyboard events, load events, click events, resize events, and drag events.

63.07	Define Windows Forms applications with graphical user interfaces (GUI) that conform to appropriate usability guidelines.
63.08	Create Windows Forms applications that use Multiple Document Interface (MDI) and Single Document Interface (SDI).
63.09	Describe visual inheritance.
63.10	Develop a Windows Forms application that inherits a form from a base application.
64.0	Develop Windows Service applications and class libraries. – The student will be able to:
64.01	Describe the characteristics and capabilities of a Windows Service application.
64.02	Describe the states in the lifetime of a service.
64.03	Describe the ServiceBase and ServiceController classes and their role in developing and controlling Windows Service applications.
64.04	Develop a Windows Service application.
64.05	Develop an installer for a Windows Service application.
64.06	Install and deploy a Windows Service application.
64.07	Test and debug a Windows Service application.
64.08	Uninstall a Windows Service application.
64.09	Develop, test, and debug a Class Library.
65.0	Demonstrate knowledge of database applications. – The student will be able to:
65.01	Explain common database terminology (e.g., relationships, normalization, fields, records, data integrity, referential integrity).
65.02	Describe the benefits and characteristics of relational databases.
65.03	Define primary keys and foreign keys and describe their purposes.
65.04	Explain how database design fits into the database application development process.
65.05	Translate an entity-relationship model into a relational database design.
65.06	Differentiate between one-to-one, one-to-many, and many-to-many relationships.
65.07	Move data from an unnormalized form through to a third normal form.
65.08	Based on information requirements, define database tables that ensure data integrity and reduce redundant data.
65.09	Describe routine maintenance for databases.
66.0	Demonstrate knowledge of structured query language (SQL) statements. – The student will be able to:

66.01	Describe the data manipulation language (DML) and describe various DML statements.
66.02	List the capabilities of SQL SELECT statements.
66.03	Write and execute a basic SELECT statement.
66.04	Write and execute SELECT statements using the WHERE clause with common operators (i.e., =, <>, >, <, >=, <=, BETWEEN, LIKE, IN).
66.05	Write and execute SELECT statements using the WHERE clause with logical operators, including AND and OR.
66.06	Write and execute SELECT statements using the ORDER BY clause.
66.07	Write and execute SELECT statements using wildcards.
66.08	Write and execute UPDATE statements to modify rows in a table.
66.09	Write and execute INSERT statements to insert rows into a table.
66.10	Write and execute DELETE statements to delete rows in a table.
66.11	Write and execute statements using JOIN to select data from two or more related tables.
66.12	Write and execute statements that use SQL to perform common calculations (e.g., AVG, MAX, MIN, SUM).
67.0	Develop .NET database applications. – The student will be able to:
67.01	Describe the purpose of ActiveX Data Objects (ADO).
67.02	Describe the purpose of the ADO connection object.
67.03	Write statements to connect to a database.
67.04	Write statements to open a database.
67.05	Write statements to create a recordset.
67.06	Write statements to commit a transaction to a database.
67.07	Write statements to rollback a transaction to a database.
67.08	Write statements to close a connection to a database.
67.09	Develop, test, and debug a database application.
67.10	Develop, test, and debug a WPF application.
68.0	Successfully work as a member of a software development team. – The student will be able to:

68.01	Accept responsibility for specific tasks in a given situation.
68.02	Document progress, and provide feedback on work accomplished in a timely manner.
68.03	Complete assigned tasks in a timely and professional manner.
68.04	Reassign responsibilities when the need arises.
68.05	Complete daily tasks as assigned on one's own initiative.
69.0	Manage time according to a plan. – The student will be able to:
69.01	Set realistic time frames and schedules.
69.02	Keep a written record of work accomplished on a daily basis.
69.03	Meet goals and objectives set by the team.
69.04	Identify individual priorities.
69.05	Complete a weekly evaluation of accomplishments, and reevaluate goals, objectives and priorities, as needed.
70.0	Keep acceptable records of progress problems and solutions. – The student will be able to:
70.01	Develop and use a record keeping system to record daily progress.
70.02	Use a project journal to identify problem statement.
70.03	Develop a portfolio of work accomplished to include requirements documents, design documents and UML, project and test plans, and prototypes.
71.0	Plan, organize, and carry out a project plan. – The student will be able to:
71.01	Identify a substantive problem that can be addressed with a .NET software solution.
71.02	Identify and document the potential customers for the project.
71.03	Identify and document the customer requirements for the project including use case definitions.
71.04	Document the proposed user interface for the project using common tools (e.g., mockups, event planning documents).
71.05	Identify the hardware and software requirements for the project.
71.06	Identify the programming tools required to develop the project.
71.07	Write a detailed design document for the project.
71.08	Write a detailed test plan for the project that addresses varying levels of testing including system testing and usability testing.
71.09	Determine the scope of a project.

71.10	Organize the team according to individual strengths.
71.11	Assign specific tasks within a team.
71.12	Determine project priorities.
71.13	Identify required resources to complete the project.
71.14	Plan, research, design, develop, and evaluate activities, as required.
71.15	Carry out the project plan to successful completion.
71.16	Document design problems, test results, product defects, and resolutions.
72.0	Manage resources. – The student will be able to:
72.01	Identify required resources for each stage of the project plan.
72.02	Determine the methods needed to acquire needed resources.
72.03	Demonstrate good judgment in the use of resources.
72.04	Recycle and reuse resources where appropriate.
72.05	Demonstrate an understanding of proper legal and ethical treatment of copyrighted material.
73.0	Use tools, materials, and processes in an appropriate and safe manner. – The student will be able to:
73.01	Identify the proper tool for a given job.
73.02	Use tools and machines in a safe manner.
73.03	Adhere to laboratory or job site safety rules and procedures.
73.04	Identify the application of processes appropriate to the task at hand.
73.05	Identify materials appropriate to their application.
74.0	Demonstrate an understanding of the software development process. – The student will be able to:
74.01	State the goals of the software application clearly.
74.02	Identify and write a plan to achieve each goal.
74.03	Develop a list of materials and content required for each goal.
74.04	Develop a step-by-step procedure for developing the application.
74.05	Follow a written procedure.

74.06	Record data from evaluation activities.
74.07	Document conclusions and solutions based on evaluation results, observations and data.
74.08	Document progress using a project log.
74.09	Write an abstract describing the project plan.
75.0	Research content related to the project and document the results following industry conventions. – The student will be able to:
75.01	Identify the basic research needed to develop the project plan.
75.02	Identify available resources for completing background research required in the project plan.
75.03	Demonstrate the ability to locate resource materials in a library, database, Internet and other research resources.
75.04	Demonstrate the ability to organize information retrieval.
75.05	Demonstrate the ability to prepare a topic outline.
75.06	Write a draft of the research report.
75.07	Edit and proof the research report. Use proper form for a bibliography, footnotes, quotations, and references.
75.08	Prepare an electronically composed research paper in proper form.
75.09	Conduct an alpha and beta evaluation of the project's product.
75.10	Write a report on the evaluations, documenting results, data, observations, and design changes based on the results.
76.0	Use presentation skills, and appropriate media to describe the progress, results and outcomes of the experience. – The student will be able to:
76.01	Prepare a multi-media presentation on the completed project.
76.02	Make an oral presentation about the project using the multi-media materials.
76.03	Review the presentation, and make changes in the delivery method(s) to improve presentation skills.
77.0	Demonstrate competency in the area of expertise related to developing computer software using the .NET framework. – The student will be able to:
77.01	Demonstrate a mastery of the content of the selected subject area.
77.02	Demonstrate the ability to use related technological tools, materials and processes related to the specific program area.
77.03	Demonstrate the ability to apply the knowledge, experience and skill developed in the previous program completion to the successful completion of this demonstration.



## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Florida Department of Education  
Curriculum Framework

**Program Title:** Web Application Development & Programming  
**Program Type:** Career Preparatory  
**Career Cluster:** Information Technology

**Career Certificate Program**

Program Number	Y700500
CIP Number	0511020102
Grade Level	30, 31
Standard Length	1050 hours
Teacher Certification	Refer to the <b><u>Program Structure</u></b> section.
CTSO	Phi Beta Lambda BPA
SOC Codes (all applicable)	15-1151 – Computer User Support Specialists 15-1131 – Computer Programmers
Basic Skills Level	Mathematics: 9 Language: 9 Reading: 9

**Purpose**

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Information Technology career cluster; provides technical skill proficiency, and includes competency-based applied learning that contributes to the academic knowledge, higher-order reasoning and problem-solving skills, work attitudes, general employability skills, technical skills, and occupation-specific skills, and knowledge of all aspects of the Information Technology career cluster.

The content includes but is not limited to the fundamentals of programming and software development; procedural and object-oriented programming; creating web-based applications, including testing, monitoring, debugging, documenting, and maintaining applications.

**Additional Information** relevant to this Career and Technical Education (CTE) program is provided at the end of this document.

## Program Structure

This program is a planned sequence of instruction consisting of four occupational completion points, with OCPs A, B, and C.

This program is comprised of courses which have been assigned course numbers in the SCNS (Statewide Course Numbering System) in accordance with Section 1007.24 (1), F.S. Career and Technical credit shall be awarded to the student on a transcript in accordance with Section 1001.44 (3)(b), F.S.

To teach the courses listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the postsecondary program structure:

OCP	Course Number	Course Title	Teacher Certification	Length	SOC Code
A	OTA0040	Information Technology Assistant	OTA0040 Teacher Certifications	150 hours	15-1151
B	CTS0041	Computer Programmer Assistant	BUS ED 1 @2	300 hours	15-1131
C	CTS0044	Computer Programmer	COMP SCI 6	150 hours	15-1131
D	CTS0034	Web Programmer	COMP PROG 7 G	450 hours	15-1131

## **Common Career Technical Core – Career Ready Practices**

Career Ready Practices describe the career-ready skills that educators should seek to develop in their students. These practices are not exclusive to a Career Pathway, program of study, discipline or level of education. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

1. Act as a responsible and contributing citizen and employee.
2. Apply appropriate academic and technical skills.
3. Attend to personal health and financial well-being.
4. Communicate clearly, effectively and with reason.
5. Consider the environmental, social and economic impacts of decisions.
6. Demonstrate creativity and innovation.
7. Employ valid and reliable research strategies.
8. Utilize critical thinking to make sense of problems and persevere in solving them.
9. Model integrity, ethical leadership and effective management.
10. Plan education and career path aligned to personal goals.
11. Use technology to enhance productivity.
12. Work productively in teams while using cultural/global competence.

## Standards

**Information Technology Assistant (OTA0040) is the first course in this and other programs within the Information Technology Career Cluster. Standards 01.0 – 14.0 are associated with this course.**

After successfully completing this program, the student will be able to perform the following:

- 01.0 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives and enhance workplace performance.
- 02.0 Develop an awareness of microprocessors and digital computers.
- 03.0 Demonstrate an understanding of operating systems.
- 04.0 Use technology to enhance the effectiveness of communication skills utilizing word processing applications.
- 05.0 Use technology to enhance communication skills utilizing presentation applications.
- 06.0 Use technology to enhance the effectiveness of communication utilizing spreadsheet and database applications.
- 07.0 Use technology to enhance communication skills utilizing electronic mail.
- 08.0 Investigate individual assessment and job/career exploration and individual career planning that reflect the transition from school to work, lifelong learning, and personal and professional goals.
- 09.0 Incorporate appropriate leadership and supervision techniques, customer service strategies, and standards of personal ethics to accomplish job objectives and enhance workplace performance.
- 10.0 Demonstrate competence using computer networks, internet and online databases to facilitate collaborative or individual learning and communication.
- 11.0 Demonstrate competence in page design applicable to the WWW.
- 12.0 Develop an awareness of emerging technologies.
- 13.0 Develop awareness of computer languages and software applications.
- 14.0 Demonstrate comprehension and communication skills.
- 15.0 Use oral and written communication skills in creating, expressing and interpreting information and ideas.
- 16.0 Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development.
- 17.0 Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types.
- 18.0 Distinguish between iterative and non-iterative program control structures.
- 19.0 Differentiate among high level, low level, procedural, object-oriented, compiled, interpreted, and translated programming languages.
- 20.0 Describe the processes, methods, and conventions for software development and maintenance.
- 21.0 Explain the types, uses, and limitations of testing for ensuring quality control.
- 22.0 Create a program design document using Unified Modeling Language (UML) or other common design tool.
- 23.0 Solve problems using critical thinking skills, creativity and innovation.
- 24.0 Use information technology tools.
- 25.0 Describe the importance of security and privacy information sharing, ownership, licensure and copyright.
- 26.0 Design a computer program to meet specific physical, operational, and interaction criteria.
- 27.0 Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types.
- 28.0 Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input.
- 29.0 Effectively communicate and collaborate.
- 30.0 Demonstrate responsible use of technology and information.

- 31.0 Explain key concepts that distinguish object-oriented programming from procedural programming.
- 32.0 Create a project plan that defines requirements, structural design, time estimates, and testing elements.
- 33.0 Design, document, and create object-oriented computer programs.
- 34.0 Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results.
- 35.0 Understand human interactions in intelligence.
- 36.0 Demonstrate proficiency using HTML and XHTML to create web content.
- 37.0 Demonstrate proficiency using cascading style sheets (CSS) to format webpages.
- 38.0 Demonstrate proficiency using basic client-side scripting to control the content and the behavior of HTML and XHTML documents.
- 39.0 Demonstrate an understanding of JavaScript programming fundamentals.
- 40.0 Demonstrate proficiency in assigning and handling variables in JavaScript programs and functions.
- 41.0 Use event handlers in JavaScript programs and functions.
- 42.0 Recognize and assign data types appropriate to their use.
- 43.0 Demonstrate proficiency in using appropriate operators to achieve a planned output.
- 44.0 Write executable statements.
- 45.0 Demonstrate an understanding of variable scope.
- 46.0 Use good programming practices.
- 47.0 Demonstrate use of the Document Object Module (DOM).
- 48.0 Use conditional control statements in JavaScript.
- 49.0 Use iterative control statements in JavaScript.
- 50.0 Use nested loop iterative control statements in JavaScript.
- 51.0 Use JavaScript to produce input and output for programs.
- 52.0 Demonstrate proficiency in using Form Objects in JavaScript programs and functions.
- 53.0 Demonstrate proficiency in using methods in JavaScript programs and functions.
- 54.0 Demonstrate proficiency in using parameters in JavaScript programs and functions.
- 55.0 Utilize debugging techniques in programs.
- 56.0 Recognize security risks in programs.
- 57.0 Use plug-ins and libraries.
- 58.0 Demonstrate proficiency in programming for mobile delivery technology (e.g., iPhone/Android).
- 59.0 Demonstrate an understanding of Personal Home Page (PHP) programming language.
- 60.0 Demonstrate proficiency in PHP configuration.
- 61.0 Demonstrate an understanding of PHP language basics.
- 62.0 Demonstrate proficiency in the use of server processes.
- 63.0 Demonstrate an understanding of object-oriented programming in PHP.
- 64.0 Demonstrate proficiency in writing PHP code to handle file input/output (I/O) operations.
- 65.0 Demonstrate proficiency in creating, populating, and using arrays in PHP.
- 66.0 Demonstrate proficiency handling strings in PHP.
- 67.0 Demonstrate proficiency in using PHP to access databases via Open Database Connectivity (ODBC).
- 68.0 Demonstrate proficiency in applying best practices for ensuring creation of a secure program.
- 69.0 Demonstrate an understanding of key technologies, protocols, and architectures associated with web development and programming.

Florida Department of Education  
Student Performance Standards

Program Title: Web Application Development & Programming  
Career Certificate Program Number: Y700500

**Course Number: OTA0040**  
**Occupational Completion Point: A**  
**Information Technology Assistant – 150 Hours – SOC Code 15-1151**

Information Technology Assistant (OTA0040) is part of several programs across the various CTE career clusters. To ensure consistency, the standards and benchmarks for this course (01.0 – 14.0) have been placed in a separate document.



**Course Number: CTS0041**  
**Occupational Completion Point: B**  
**Computer Programmer Assistant – 300 Hours – SOC Code 15-1131**

15.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:
15.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.
15.02	Locate, organize and reference written information from various sources.
15.03	Construct writings and/or communications using developmentally appropriate terminology.
15.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.
15.05	Analyze the positive and negative impacts of technology on popular culture and personal life.
15.06	Discuss how technology has changed the way people build and manage organizations and how technology impacts personal life.
15.07	Evaluate ways in which adaptive technologies may assist users with special needs.
15.08	Explain how societal and economic factors are affected by access to critical information.
15.09	Discuss the challenges (e.g., political, social, and economic) in providing equal access and distribution of technology in a global society.
16.0	Explore the characteristics, tasks, work attributes, options, and tools associated with a career in software development. – The student will be able to:
16.01	Explore a variety of careers to which computing is central.
16.02	Compare and contrast appropriate and inappropriate social networking behaviors.
16.03	Discuss the impact of computing on business and commerce (e.g., automated inventory processing, financial transactions, e-commerce, virtualization, cloud computing).
16.04	Evaluate the impacts of irresponsible use of information (e.g., plagiarism, falsification of data) on collaborative projects.
16.05	Identify tasks performed by programmers.
16.06	Describe how businesses use computer programming to solve business problems.
16.07	Investigate job opportunities in the programming field.
16.08	Explain different specializations and the related training in the computer programming field.
16.09	Explain the need for continuing education and training of computer programmers.
16.10	Understand and identify ways to use technology to support lifelong learning.
16.11	Explain enterprise software systems and how they impact business.

16.12	Describe ethical responsibilities of computer programmers.
16.13	Describe the role of customer support to software program quality.
16.14	Identify credentials and certifications that may improve employability for a computer programmer.
16.15	Identify devices, tools, and other environments for which programmers may develop software.
17.0	Demonstrate an understanding of the characteristics, use, and selection of numerical, non-numerical, and logical data types. – The student will be able to:
17.01	Identify the characteristics (e.g., size, limits) and uses of different numerical and non-numerical data types.
17.02	Explain the types and uses of variables in programs.
17.03	Determine the best data type to use for given programming problems.
17.04	Compare and contrast simple data structures and their uses.
17.05	Identify the types of operations that can be performed on different data types.
17.06	Evaluate arithmetic and logical expressions using appropriate operator precedence.
17.07	Explain how computers store different data types in memory.
17.08	Demonstrate the difference between "data" and "information".
17.09	Use different number systems to represent data.
17.10	Explain how national and international standards (i.e., ASCII, UNICODE) are used to represent non-numerical data.
17.11	Use Boolean logic to perform logical operations.
18.0	Distinguish between iterative and non-iterative program control structures–The student will be able to:
18.01	Create non-iterative programming structures and explain their uses.
18.02	Create iterative programming structures and explain their uses.
18.03	Explain how sequence, selection, and iteration are building blocks of algorithms.
19.0	Differentiate among procedural, object-oriented, compiled, interpreted, and translated programming languages. – The student will be able to:
19.01	Differentiate between multiple levels of an operating system, translation, and interpretation that support program execution.
19.02	Explain the program execution process (by an interpreter and in CPU hardware).
19.03	Describe object-oriented concepts.

19.04	Explain the characteristics of procedural and object-oriented programming languages.
19.05	Compare and contrast programming languages that are compiled, interpreted, and translated.
19.06	Classify programming languages by paradigm and application domain (e.g., imperative, functional, logic languages and how well suited they are for certain application domains such as web programming, symbolic processing, data/numerical processing).
20.0	Describe the processes, methods, and conventions for software development and maintenance. – The student will be able to:
20.01	Describe a software development process that is used to solve problems at different software development stages.
20.02	Describe and demonstrate ethical and responsible use of modern communication media and devices.
20.03	Define alternative methods of program development (e.g., rapid prototyping, waterfall, spiral model, peer coding).
20.04	List and explain the steps in the program development cycle.
20.05	Describe different types of documentation used in the program development cycle (e.g., requirements document, program design documents, test plans).
20.06	Describe different methods used to facilitate version control.
21.0	Explain the types, uses, and limitations of testing for ensuring quality control. – The student will be able to:
21.01	Explain the uses and limits of testing in ensuring program quality.
21.02	Explain testing performed at different stages of the program development cycle (e.g., unit testing, system testing, user acceptance testing).
21.03	Describe and identify types of programming errors.
21.04	Analyze and manipulate data collected by a variety of data collection techniques.
21.05	Explain what tools are applied to provide automated testing environments.
22.0	Create a program design document using common design tool. – The student will be able to:
22.01	Describe different design methodologies and their uses (e.g., object-oriented design, structured design, rapid application development).
22.02	Describe tools for developing a program design (e.g., Unified Modeling Language, flowcharts, design documents, pseudocode).
22.03	Explain the role of existing libraries and packages in facilitating programmer productivity.
22.04	Participate and contribute to a design review of a program design developed using a common program design tool (e.g., UML, flowcharts, design documents, pseudocode).
22.05	Write a program design document using standard design methodology.
22.06	Define input and output for a program module using standard design methodology.

23.0	Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:
23.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.
23.02	Employ critical thinking and interpersonal skills to resolve conflicts.
23.03	Identify and document workplace performance goals and monitor progress toward those goals.
23.04	Conduct technical research to gather information necessary for decision-making.
23.05	Discuss digital tools or resources to use for a real-world task based on their efficiency and effectiveness, individually and collaboratively.
24.0	Use information technology tools. – The student will be able to:
24.01	Use personal information management (PIM) applications to increase workplace efficiency.
24.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.
24.03	Employ computer applications to access, create, manage, integrate, and store information.
24.04	Employ collaborative/groupware applications to facilitate group work.
24.05	Use a development process in creating a computational artifact, individually and collaboratively, followed by reflection, analysis, and iteration (e.g., data-set analysis program for science and engineering fair, capstone project that includes a program, term research project based on program data).
25.0	Describe the importance of security and privacy information sharing, ownership, licensure and copyright. – The student will be able to:
25.01	Describe security and privacy issues that relate to computer networks including the permanency of data on the Internet, online identity, and privacy.
25.02	Discuss the impact of government regulation on privacy and security.
25.03	Describe how different types of software licenses (e.g., open source, proprietary licenses) can be used to share and protect intellectual property.
25.04	Explain how access to information may not include the right to distribute the information.
25.05	Describe differences between open source, freeware, and proprietary software licenses, and how they apply to different types of software.
25.06	Discuss security and privacy issues that relate to computer networks.
25.07	Identify computer-related laws and analyze their impact on digital privacy, security, intellectual property, network access, contracts, and harassment.
26.0	Design a computer program to meet specific physical, operational, and interaction criteria. – The student will be able to:
26.01	Choose appropriate data types depending on the needs of the program.

26.02	Define appropriate user prompts for clarity and usability (e.g., user guidance for data ranges, data types).
26.03	Design and develop program for efficiency (e.g., less memory usage, less inputs/outputs, faster processing).
26.04	Compare techniques for analyzing massive data collections.
26.05	Identify the software environment required for a program to run (e.g., operating system required, mobile, web-based, desktop, delivery method).
26.06	Create mobile computing applications and/or dynamic webpages through the use of a variety of design and development tools, programming languages and mobile devices/emulators.
26.07	Explain the role of an application programming interface (API) in the development of applications and the distinction between a programming language's syntax and the API.
26.08	Identify the tools required to develop a program (e.g., editors, compilers, linkers, integrated development environments, APIs, libraries).
26.09	Use an industrial-strength integrated development environment to implement a program.
27.0	Create and document a computer program that uses a variety of internal and control structures for manipulating varied data types. – The student will be able to:
27.01	Use appropriate naming conventions to define program variables and methods.
27.02	Use a program editor to write the source code for a program.
27.03	Write programs that use selection structures.
27.04	Write programs that use repetition structures.
27.05	Write programs that use nested structures.
27.06	Use internal documentation (e.g., single-line and multi-line comments, program headers, module descriptions, meaningful variable and function/module names) to document a program according to accepted standards.
27.07	Compile, run, test and debug programs.
27.08	Write programs that use standard arithmetic operators with different numerical data types.
27.09	Write programs that use standard logic operators.
27.10	Write programs that use a variety of common data types.
27.11	Write programs that perform data conversion between standard data types.
27.12	Write programs that define, use, search, and sort arrays.
27.13	Write programs that use user-defined data types.

27.14	Demonstrate understanding and use of appropriate variable scope.
27.15	Explain recursive programming structure.
27.16	Use global and local scope appropriately in program implementation.
28.0	Create and document an interactive computer program that employs functions, subroutines, or methods to receive, validate, and process user input. – The student will be able to:
28.01	Critically examine classical algorithms and implement an original algorithm.
28.02	Write programs that perform user input and output.
28.03	Write programs that validate user input (e.g., range checking, data formats, valid/invalid characters).
28.04	Write program modules such as functions, subroutines, or methods.
28.05	Write program modules that accept arguments.
28.06	Write program modules that return values.
28.07	Write program modules that validate arguments and return error codes.
28.08	Design and implement a simple simulation algorithm to analyze, represent and understand natural phenomena.
28.09	Use APIs and libraries to facilitate programming solutions.
28.10	Participate in a peer code review to verify program functionality, programming styles, program usability, and adherence to common programming standards.
29.0	Effectively communicate and collaborate. – The student will be able to:
29.01	Evaluate modes of communication and collaboration.
29.02	Select appropriate tools within a project environment to communicate with project team members.
29.03	Utilize project collaboration tools (such as version control systems and integrated development environments) while working on a collaborative software project.
29.04	Generate, evaluate, and prioritize questions that can be researched through digital resources and online tool.
29.05	Perform advanced searches to locate information and/or design a data-collection approach to gather original data.
29.06	Communicate and publish key ideas and details to a variety of audiences using digital tools and media-rich resources.
30.0	Demonstrate responsible use of technology and information. – The student will be able to:
30.01	Explain the principles of cryptography by examining encryption, digital signatures, and authentication methods (e.g. explain why and how certificates are used with https for authentication and encryption).

30.02 Implement an encryption, digital signature, or authentication method.

30.03 Describe computer security vulnerabilities and methods of attack, and evaluate their social and economic impact on computer systems and people.

**Course Number: CTS0044**  
**Occupational Completion Point: C**  
**Computer Programmer – 150 Hours – SOC Code 15-1131**

31.0	Explain key concepts that distinguish object-oriented programming from procedural programming. – The student will be able to:
31.01	Demonstrate the understanding and use of classes, objects, attributes, and behaviors.
31.02	Demonstrate the understanding and use of inheritance.
31.03	Demonstrate the understanding and use of data encapsulation.
31.04	Demonstrate the understanding and use of polymorphism.
31.05	Use predefined functions and parameters, classes, and methods to divide a complex problem into simpler parts by using the principle of abstraction to manage complexity (e.g., by using searching and sorting as abstractions).
32.0	Create a project plan for an object-oriented programming project that defines requirements, structural design, time estimates, and testing elements. – The student will be able to:
32.01	Write a project plan for completion of a project that includes gathering program requirements, developing the program, and testing it.
32.02	Write a program requirements document that identifies business purpose, functional requirements, system requirements, and other common components of a requirements document.
32.03	Design an object-oriented program using standard design methodology.
32.04	Work with other team members to develop a project plan for a program.
32.05	Work with other team members to write a design document for a program with multiple functions and shared data.
32.06	Participate in design meetings that review program design documents for conformance to program requirements.
32.07	Estimate the time to develop a program or module.
32.08	Evaluate algorithms by their efficiency, correctness, and clarity (e.g., by analyzing and comparing execution times, testing with multiple inputs or data sets, and by debugging).
33.0	Design, document, and create object-oriented computer programs. – The student will be able to:
33.01	Compare and contrast recursive functions to iterative methods.
33.02	Understand the implementation of character strings in the programming language.
33.03	Write programs that perform string processing (e.g., manipulating, comparing strings, concatenation).
33.04	Write programs that implements user-defined data types.
33.05	Decompose a problem by defining new functions and classes.



33.06	Write object-oriented programs that implement inheritance.
33.07	Write object-oriented programs that implement polymorphism.
33.08	Develop class constructors.
33.09	Write programs that define and use program constants.
33.10	Write programs that perform error handling.
33.11	Participate in program code review meetings to evaluate program code for validity, quality, performance, data integrity, and conformance to program design documents.
33.12	Describe the concept of parallel processing as a strategy to solve large problems.
33.13	Demonstrate concurrency by separating processes into threads of execution and dividing data into parallel streams.
33.14	Update a program module to implement enhancements or corrections and demonstrate appropriate documentation (internal and external) related to version control.
33.15	Write programs that use complex data structures (e.g., stacks, queues, trees, linked list).
33.16	Write programs that are event-driven.
33.17	Write programs that perform file input and output (i.e., sequential and random access file input/output).
33.18	Explain intractable problems and understand that problems exist that are computationally unsolvable (undecidable) (e.g., classic intractable problems include Towers of Hanoi, TSP).
33.19	Explain the value of heuristic algorithms to approximate solutions for intractable problems (e.g., a heuristic solution to TSP).
34.0	Design a unit test plan for an object-oriented computer program, test and debug the program, and report the results. – The student will be able to:
34.01	Develop a test plan for an object-oriented program.
34.02	Write test plans for event-driven programs.
34.03	Write test plans for programs that perform file input and output.
34.04	Perform test and debug activities on object-oriented programs, including those written by someone else.
34.05	Perform test and debug activities on an event-driven program.
34.06	Perform test and debug activities on programs that perform file input and output and verify the correctness of output files.
34.07	Document the findings of testing in a test report.

35.0	Understand human interactions in intelligence. – The student will be able to:
35.01	Describe the unique features of computers embedded in mobile devices and vehicles.
35.02	Describe the common physical and cognitive challenges faced by users when learning to use software and hardware.
35.03	Describe the process of designing software to support specialized forms of human-computer interaction.
35.04	Explain the notion of intelligent behavior through computer modeling and robotics.
35.05	Describe common measurements of machine intelligence (e.g., Turing test).
35.06	Describe a few of the major branches of artificial intelligence (e.g., expert systems, natural language processing, machine perception, machine learning).
35.07	Describe major applications of artificial intelligence and robotics, including, but not limited to, the medical, space, and automotive fields.

**Course Number: CTS0034**  
**Occupational Completion Point – D**  
**Web Programmer – 450 Hours – SOC Code 15-1131**

36.0	Demonstrate proficiency using HTML and XHTML to create web content. — The student will be able to:
36.01	Use storyboarding techniques for designing a website (e.g., linear, hierarchical).
36.02	Identify elements of a webpage.
36.03	Create webpages using HTML and XHTML tags that create basic elements (e.g., links, lists, formatted text, tables).
36.04	Create webpages that utilize tables to achieve complex layout.
36.05	Add graphic content to webpages.
36.06	Create webpages that utilize client-side image maps.
36.07	Develop, integrate, and apply the use of forms in website design.
36.08	Optimize web content for desirable search engine placement.
36.09	Demonstrate an understanding of browser compatibility issues by designing pages that comply with the current web Content Accessibility Guidelines issued by the World Wide Web Consortium (W3C).
36.10	Demonstrate an understanding of web accessibility issues by developing pages that meet Bobby accessibility checker criteria.
36.11	Explain basic XML syntax and how XHTML conforms to the XML standard.
36.12	Use a WYSIWYG editor to develop and manage a website.
36.13	Use markup validation tools to test HTML and XHTML documents for well-formed elements and make all corrections necessary to ensure compliance with W3C standards.
36.14	Analyze and modify HTML and XHTML source code developed by others.
37.0	Demonstrate proficiency using cascading style sheets (CSS) to format webpages. – The student will be able to: Explain the advantages and disadvantages of using Cascading Style Sheets (CSS) to format webpages.
37.01	Describe the difference between linked, embedded, imported and inline styles and explain how styles are inherited.
37.02	Explain the difference between classes, id, and span elements.

37.03	Utilize CSS properties within webpages to control page layout, fonts, colors, backgrounds, and other presentation effects.
37.04	Demonstrate understanding of the Box Model.
37.05	Demonstrate proficiency in creating 1 to 3 column layouts.
37.06	Create navigation system through CSS.
38.0	Demonstrate proficiency using basic client-side scripting to control the content and the behavior of HTML and XHTML documents. – The student will be able to:
38.01	Describe the difference between server-side and client-side processing.
38.02	Describe the term “scripting language” and explain how scripting languages differ from compiled languages.
38.03	Create webpages that employ client-side scripting to control content and display.
39.0	Demonstrate an understanding of JavaScript programming fundamentals. – The student will be able to:
39.01	Describe server side versus client side applications including interpreters.
39.02	Describe the purpose and use of an interpreter in relation to JavaScript.
39.03	Describe differences in different types of JavaScript implementations (i.e., Jscript, ECMA).
39.04	Declare and initialize variables.
39.05	Assign new values to variables.
39.06	Create and use constant variables.
39.07	Describe the difference of programming languages versus scripting languages.
39.08	Describe object based nature and platform independence.
39.09	Describe and demonstrate inline scripting.
40.0	Demonstrate proficiency in assigning and handling variables in JavaScript programs and functions. – The student will be able to:
40.01	Describe how variables are used in programs.
40.02	Identify which data type should be used for a given value.
40.03	Identify the syntax for using variables.
40.04	Declare and initialize variables.
40.05	Assign new values to variables.

40.06	Create and use constant variables.
40.07	Describe and demonstrate the use of properties.
40.08	Describe identifiers and identify valid and invalid identifiers.
40.09	Describe and identify reserved words, delimiters, literals, and comments.
41.0	Use event handlers in JavaScript programs and functions. – The student will be able to:
41.01	Describe the event model and five events (form, image, map, link, and window).
41.02	Demonstrate and use the window events load, focus, blur, and unload.
41.03	Demonstrate and use the form events change, reset, and submit.
41.04	Demonstrate and use the text events cut, paste, select, and copy.
41.05	Demonstrate and use the mouse events mousemove, mousedown, click, mousewheel, mouseover, mouseout and mouseover.
41.06	Demonstrate and use the keyboard events keyup, keydown, keypress.
41.07	Demonstrate using the appropriate event handlers with their associated events.
42.0	Recognize and assign data types appropriate to their use. – The student will be able to:
42.01	Describe the data type categories.
42.02	Give examples of var, primitives, null, and undefined data types.
42.03	Demonstrate the use of var in relation to other datatypes.
43.0	Demonstrate proficiency in using appropriate operators to achieve a planned output. – The student will be able to:
43.01	Construct statements using arithmetic operators.
43.02	Construct statements using relational operators.
43.03	Construct and use statements using logical operators.
43.04	Construct and use statements using string concatenation, and strict comparison.
43.05	Construct and use statements using assignment operators.
43.06	Construct and execute statements using operator precedence.

44.0	Write executable statements. – The student will be able to:
44.01	Construct variable assignment statements.
44.02	Construct statements using built-in functions.
44.03	Describe when implicit data type conversions take place.
44.04	List the drawbacks of implicit data type conversions.
44.05	Construct statements using functions to explicitly convert data types.
45.0	Demonstrate an understanding of variable scope. – The student will be able to:
45.01	Understand the scope and visibility of variables.
45.02	Write programs using local variables.
45.03	Describe the scope of a variable.
46.0	Use good programming practices. – The student will be able to:
46.01	List examples of good programming practices.
46.02	Insert comments into code.
46.03	Demonstrate the use of <no script> tag.
46.04	Follow formatting guidelines when writing code.
46.05	Understand the different types of errors produced by programs.
47.0	Demonstrate use of the Document Object Module (DOM). – The student will be able to:
47.01	Create and use user defined objects.
47.02	Create user defined objects with properties and methods.
47.03	Describe and Use the Array Object including its parameters, properties, and methods (chop, join, pop, push, splice, split).
47.04	Describe and Use the Date Object including its multiple constructors, properties, and methods (getDay, getMonth, getYear, getMinutes, getHous, getTime).
47.05	Describe and use the Window Object including \properties, and methods.
47.06	Describe and use the Image Object including its properties, and methods.

47.07	Describe and use the History Object including its properties, and methods.
47.08	Describe and use the RegEx Object for basic and complex regular expressions.
47.09	Describe and use the String Object including its properties, and methods.
47.10	Describe and use the Math Object including its properties, and methods.
48.0	Use conditional control statements in JavaScript. – The student will be able to:
48.01	Construct and use an if statement.
48.02	Construct and use a switch statement.
48.03	Construct and use a while, do while, and for loop.
48.04	Construct and use a conditional operator.
49.0	Use iterative control statements in JavaScript. – The student will be able to:
49.01	Describe the types of loop statements and their uses.
49.02	Construct and use the while and do while loop.
49.03	Construct and use the for loop.
49.04	Describe when a while loop is used.
49.05	Describe when a for loop is used.
50.0	Use nested loop iterative control statements in JavaScript. – The student will be able to:
50.01	Construct and execute a program using nested loops.
50.02	Construct and execute a loop using break and continue.
50.03	Evaluate a nested loop construct and sentinel value.
51.0	Use JavaScript to produce input and output for programs. – The student will be able to:
51.01	Describe and use the prompt() and confirm() to input data into programs.
51.02	Describe and demonstrate the use of the alert() to produce output to the console.

51.03	Describe and demonstrate how to input data using JavaScript Events.
51.04	Describe and demonstrate how to output using the document.write().
51.05	Explain the difference of prompt() and confirm() functions.
51.06	Create and use escape sequences.
52.0	Demonstrate proficiency in using Form Objects in JavaScript programs and functions. – The student will be able to:
52.01	Use Form objects to validate input.
52.02	Access the value of the form object through its associated method.
52.03	Describe and use button, checkbox, textarea, select, radio, hidden, and text objects.
52.04	Access and modify values and attributes at runtime using getElementById, getElementsByName, getElementsByTagName, and inner HTML.
53.0	Demonstrate proficiency in using methods in JavaScript programs and functions. – The student will be able to:
53.01	Differentiate between anonymous methods and methods.
53.02	Identify the benefits of using methods.
53.03	Describe and use inner method.
53.04	Create a method.
53.05	Describe how a method is invoked.
54.0	Demonstrate proficiency in using parameters in JavaScript programs and functions. – The student will be able to:
54.01	Describe how parameters are passed into functions.
54.02	Define a parameter.
54.03	Create a method using a parameter.
54.04	Invoke a method that has parameters.
54.05	Distinguish between formal and actual parameters.



55.0	Utilize debugging techniques in programs. – The student will be able to:
55.01	Use the display property to enable/disable code blocks.
55.02	Use document.write() to log program execution.
55.03	Test program in different browsers and mobile devices for compatibility errors.
55.04	Use comments as a flow control while debugging.
56.0	Recognize security risks in programs. – The student will be able to:
56.01	Describe the security risk of cookies and browsers.
56.02	Identify security responsibilities of browsers and operating system.
56.03	Describe security systems such as frame to frame URL changing.
56.04	Describe the use of signed scripts.
56.05	Create and use cookies in a secure manner.
57.0	Use plug-ins and libraries. – The student will be able to:
57.01	Use external libraries in the program.
57.02	Describe and contrast the following industry libraries JQuery, Dojo, LightBox, and Moo Tools, PhoneGap.
57.03	Describe different types of libraries full, effects, tools, graphing, math, cryptography, and AJAX.
57.04	Identify how load and reference external and user made scripts.
57.05	Describe AJAX elements and procedures.
57.06	Describe XML.
57.07	Demonstrate the use of XMLHttpRequest to retrieve data.
58.0	Demonstrate proficiency in programming for mobile delivery technology (e.g., iPhone/Android). – The student will be able to:
58.01	Respond to multi-touch and gesture events.
58.02	Describe and demonstrate the use of webkit CSS.

58.03	Use the meta tag to enable native look and feel.
58.04	Create a splash screen.
58.05	Describe and demonstrate app caching.
58.06	Describe and demonstrate use of JQuery for mobile development.
58.07	Describe how to publish the app using XCode.
59.0	Demonstrate an understanding of Personal Home Page (PHP) programming language. – The student will be able to:
59.01	Describe the evolution of PHP as a programming language.
59.02	Discuss the strengths and limitations of PHP.
60.0	Demonstrate proficiency in PHP configuration. – The student will be able to:
60.01	Set up a PHP host (wamp, mamp, online).
60.02	Configure PHP for File Transfer Protocol (FTP) access.
60.03	Configure the config.php file.
61.0	Demonstrate an understanding of PHP language basics. – The student will be able to:
61.01	Describe how variables are declared, referenced, and passed.
61.02	Describe the control structures inherent with PHP programming.
61.03	Describe the three types of arrays used in PHP.
61.04	Describe how functions in PHP are created, called, and controlled.
62.0	Demonstrate proficiency in the use of server processes. – The student will be able to:
62.01	Describe a session and explain its importance and use in web programming.
62.02	Describe the server processes associated with forms handling.
62.03	Compare and contrast the use of GET and POST.
62.04	Describe cookies and explain their use, population, control, and risks.
62.05	Describe HTTP Headers and their role in web development.
62.06	Describe HTTP Authentication.

63.0	Demonstrate an understanding of object-oriented programming in PHP. – The student will be able to:
63.01	Create classes using PHP.
63.02	Describe inheritance and its role in PHP programming.
63.03	Write PHP code to handle exceptions.
63.04	Write PHP code to accommodate different interfaces.
64.0	Demonstrate proficiency in writing PHP code to handle file input/output (I/O) operations. – The student will be able to:
64.01	Write PHP code to perform open, read, and write operations on files.
64.02	Write PHP code to initiate file system functions.
64.03	Write PHP code to handle streams.
65.0	Demonstrate proficiency in creating, populating, and using arrays in PHP. – The student will be able to:
65.01	Create, populate and write code to extract information from a numeric array in PHP.
65.02	Create, populate and write code to extract information from an associative array in PHP.
65.03	Create, populate and write code to extract information from a multidimensional array in PHP.
66.0	Demonstrate proficiency handling strings in PHP. – The student will be able to:
66.01	Write PHP code to retrieve or extract one or more characters from a string.
66.02	Write PHP code to convert a string from data type to another.
66.03	Write PHP code to manipulate the display characteristics of string data.
66.04	Write PHP code that uses string data to control program flow.
66.05	Write PHP code to join array elements with a string.
67.0	Demonstrate proficiency in using PHP to access databases via Open Database Connectivity (ODBC). – The student will be able to:
67.01	Write PHP code to create an ODBC connection and retrieve information from a database using the appropriate Structured Query Language (SQL) statement.
67.02	Describe a prepared statement and discuss its primary advantages (e.g., code efficiency, SQL Injection prevention).
67.03	Create a prepared statement to perform specific SQL actions.

67.04	Describe a PHP Data Object (PDO) transaction and explain its primary advantages.
67.05	Create a prepared statement and associated result set using PDOStatement.
68.0	Demonstrate proficiency in applying best practices for ensuring creation of a secure program. – The student will be able to:
68.01	Describe an SQL Injection, its consequences, and ways in which it may be prevented via programming.
68.02	Describe the Remote Code Injection vulnerability in PHP and ways in which it may be prevented.
68.03	Describe the risk of session hijacking in PHP and ways to program around it.
68.04	Describe the risks associated with uploading files in PHP and ways in which risks might be mitigated.
68.05	Describe Secure Sockets Layer (SSL) and usage issues related to PHP.
69.0	Demonstrate an understanding of key technologies, protocols, and architectures associated with web development and programming. – The student will be able to:
69.01	SimpleXML functions.
69.02	Extensible Markup Language (XML) Extension.
69.03	XML Path Language (XPath).
69.04	Web Services.
69.05	Simple Object Access Protocol (SOAP).
69.06	Representational State Transfer (REST).
69.07	JavaScript Object Notation (JSON).
69.08	Asynchronous JavaScript and XML (AJAX).

## **Additional Information**

### **Laboratory Activities**

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental, quality, and safety procedures are an integral part of this career and technical program/course. Laboratory investigations benefit all students by developing an understanding of the complexity and ambiguity of empirical work, as well as the skills required to manage, operate, calibrate and troubleshoot equipment/tools used to make observations. Students understand measurement error; and have the skills to aggregate, interpret, and present the resulting data. Equipment and supplies should be provided to enhance hands-on experiences for students.

### **Special Notes**

MyCareerShines is an interactive resource to assist students in identifying their ideal career and to enhance preparation for employment. Teachers are encouraged to integrate this resource into the program curriculum to meet the employability goals for each student.

### **Career and Technical Student Organization (CTSO)**

Phi Beta Lambda and Business Professionals of America (BPA) are the intercurricular student organizations providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

### **Cooperative Training – OJT**

On-the-job training is appropriate but not required for this program. Whenever offered, the rules, guidelines, and requirements specified in the OJT framework apply.

### **Basic Skills**

In Career Certificate Programs offered for 450 hours or more, in accordance with Rule 6A-10.040, F.A.C., the minimum basic skills grade levels required for postsecondary adult career and technical students to complete this program are: Mathematics 9, Language 9, and Reading 9. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination.

Adult students with disabilities, as defined in Section 1004.02(7), Florida Statutes, may be exempted from meeting the Basic Skills requirements (Rule 6A-10.040). Students served in exceptional student education (except gifted) as defined in s. 1003.01(3)(a), F.S., may also be exempted from meeting the Basic Skills requirement. Each school district and Florida College must adopt a policy addressing procedures for exempting eligible students with disabilities from the Basic Skills requirement as permitted in Section 1004.91(3), F.S.

Students who possess a college degree at the Associate of Applied Science level or higher; who have completed or are exempt from the college entry-level examination; or who have passed a state, national, or industry licensure exam are exempt from meeting the Basic Skills requirement (Rule 6A-10.040, F.A.C.) Exemptions from state, national or industry licensure are limited to the certifications listed on the Basic Skills and Licensure Exemption List which may be accessed from the CTE Program Resources page.

## **Accommodations**

Federal and state legislation requires the provision of accommodations for students with disabilities to meet individual needs and ensure equal access. Postsecondary students with disabilities must self-identify, present documentation, request accommodations if needed, and develop a plan with their counselor and/or instructors. Accommodations received in postsecondary education may differ from those received in secondary education. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

Note: postsecondary curriculum and regulated secondary programs cannot be modified.