Florida Department of Education
Curriculum Framework

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

Secondary – Career Preparatory	
Program Number	9005200
CIP Number	0511080401
Grade Level	9-12, 30, 31
Standard Length	5 credits
Teacher Certification	COMPU SCI 6 TEC ED 1 @2 ENG 7G ENG TECH 7G INFO TECH 7G COMP PROG 7G ROBOTICS 7G BUS ED 1 @2
CTSO	FBLA BPA TSA
SOC Codes (all applicable)	15-1199 – Computer Occupations, All Other 15-1132.00 Software Developers, Applications 15-1131.00 Computer Programmer
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

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, 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 three to four occupational completion points. Students enrolling in this program must be computer literate. This literacy can be achieved by completing one credit of the Business Technology Education core, including Computing for College and Careers (8209020) or Introduction to Information Technology (8207310). It is also recommended that students complete academic courses in visual arts, computer arts, or digital arts. A student who completes the applicable competencies at any occupational completion point may either continue with the training program or exit as an occupational completer.

The following table illustrates the secondary program structure:

A BTE Core	9005210 8200320 8200330	Modeling and Simulation Foundations **Or** Applied Computer Business Skills I **And** Applied Computer Business Skills II **OR**	1 credit .5 credit .5 credit	15-1199	2 2 2	VO VO
	8209020	Computing for College and Careers **OR**	1 credit		2	PA
	8207310	Introduction to Information Technology	1 credit		2	PA
B	9005220	Modeling and Simulation Design	1 credit	15-1199	2	VO
C	9005230	Modeling and Simulation Applications	1 credit	15-1131	3	VO
D	9005240	Modeling and Simulation Prototyping and Innovation	1 credit	15-1131	3	VO

(Graduation Requirement Abbreviations- EQ= Equally Rigorous Science, PA= Practical Arts, EC= Economics, VO= Career and Technical Education)

Academic Alignment Table

Academic alignment is an ongoing, collaborative effort of professional educators specializing in the fields of science, mathematics, English/language arts, and Career and Technical Education (CTE). This initiative supports CTE programs by improving student performance through the integration of academic content within CTE courses. Career and Technical Education courses that have been aligned to the Next Generation Sunshine State Standards for Science and the Florida Standards for Mathematics and English/Language Arts will show the following data: the quantity of academic standards in the CTE course; the total number of standards contained in the academic course; and the percentage of alignment to the CTE course.

Courses	Anatomy/ Physiology Honors	Astronomy Solar/Galactic Honors	Biology 1	Chemistry 1	Earth-Space Science	Environmental Science	Genetics Honors	Integrated Science 1	Marine Science 1 Honors	Physical Science	Physics 1
9005210	#	5/80 6%	9/83 11%	3/69 4%	4/67 6%	19/70 27%	2/69 3%	9/82 11%	17/66 26%	4/74 35%	3/72 4%
8200320	11/87 13%	11/80 14%	24/83 29%	11/69 16%	24/67 36%	9/70 13%	11/69 16%	24/82 29%	11/66 17%	24/74 32%	10/72 14%
8200330	11/87 13%	11/80 14%	5/83 6%	11/69 16%	5/67 7%	9/70 13%	11/69 16%	5/82 6%	11/66 17%	5/74 7%	10/72 14%
8209020	13/87 15%	25/80 31%	35/83 42%	20/69 29%	35/67 52%	23/70 33%	13/69 19%	33/82 40%	24/66 36%	40/74 54%	20/72 28%
8207310	5/87 6%	5/80 6%	24/83 29%	5/69 7%	24/67 36%	5/70 7%	5/69 7%	24/82 29%	5/66 8%	24/74 32%	5/72 7%
9005220	#	#	#	#	#	#	#	#	#	#	#
9005230	20/87 23%	25/80 31%	1/83 1%	22/69 32%	4/67 6%	22/70 31%	21/69 30%	3/82 4%	18/66 27%	5/74 7%	26/72 36%
9005240	19/87 22%	19/80 24%	#	19/69 28%	#	19/70 27%	19/69 28%	#	14/66 21%	#	20/72 28%

*** Alignment pending review* *# Alignment attempted, but no correlation to academic course*

Courses	Algebra 1	Algebra 2	Geometry	English 1	English 2	English 3	English 4
9005210	14/67 21%	8/75 11%	14/54 26%	9/46 20%	9/45 20%	#	#
8200320	25/67 37%	14/75 19%	18/54 33%	40/46 87%	40/45 89%	40/45 89%	40/45 89%
8200330	37/67 55%	23/75 31%	22/54 41%	32/46 70%	32/45 71%	32/45 71%	32/45 71%
8209020	27/67 40%	19/75 25%	18/54 33%	40/46 87%	40/45 89%	40/45 89%	40/45 89%
8207310	20/67 30%	15/75 20%	18/54 33%	40/46 87%	40/45 89%	40/45 89%	40/45 89%
9005220	15/67 22%	9/75 12%	15/54 28%	11/46 24%	11/45 24%	#	#
9005230	13/67 19%	23/75 31%	11/54 20%	1/46 2%	1/45 2%	6/45 13%	6/45 13%
9005240	12/67 18%	17/75 23%	11/54 20%	#	#	10/45 22%	10/45 22%

*** Alignment pending review* *# Alignment attempted, but no correlation to academic course*

Program Recommendations

The Modeling and Simulation program lends itself to integration of the core academic subjects of language arts, math, science, visual arts, and

social studies into project activities. It is through a balanced and integrated curriculum that students attain the attitudes, skills, and knowledge needed to compete successfully in today's work force. Implementation models that encourage curriculum integration provide a strong foundation for cross content curricular instruction. Ideally, Modeling and Simulation teachers and cooperating teachers would be provided with collaborative planning time and would work jointly to achieve the goals of the program.
This program emphasizes the development of technical abilities as well as ethical and societal 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 collaboratively 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.

The Modeling and Simulation program places a strong emphasis on workplace learning. Job shadowing and mentoring experiences with Modeling and Simulation 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.

Florida Standards for Technical Subjects

Florida Standards (FS) for English Language Arts and Literacy in History/Social Studies, Science, and Technical Subjects are the critical reading and writing literacy standards designed for grade 6 and above. These standards are predicated on teachers of history/social studies, science, and technical subjects using their content area expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. It is important to note that the 6-12 literacy standards in history/social studies, science, and technical subjects are not meant to replace content standards in those areas but rather to supplement them.
This curriculum framework incorporates the grades 9-10 reading and writing literacy standards in the first two courses of this CTE program and grade 11-12 reading and writing literacy standards in the third and fourth courses of this CTE program. The standards for Mathematical Practices describe varieties of expertise that educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in mathematics education. This curriculum framework incorporates the appropriate mathematical practices in the first four courses of this CTE program.

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.SI.1.1

English Language Development (ELD) Standards Special Notes:

Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL’s need for communication and social skills. To access an ELL supporting document which delineates performance definitions and descriptors, please click on the following link: http://www.cpalms.org/uploads/docs/standards/eld/SI.pdf.

For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement

through Language Acquisition at sala@fldoe.org.

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 Methods and strategies for using Florida Standards for grades 09-10 reading in Technical Subjects for student success in Modeling and Simulation.
02.0 Methods and strategies for using Florida Standards for grades 09-10 writing in Technical Subjects for student success in Modeling and Simulation.
03.0 Methods and strategies for using Florida Standards for grades 09-10 Mathematical Practices in Technical Subjects for student success in Modeling and Simulation.
04.0 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.
05.0 Demonstrate information fluency using emerging research techniques and technology.
06.0 Demonstrate a knowledge of the information technology industry, the history of computers including their components and functionality, as they relate to Modeling and Simulation.
07.0 Explain intelligent systems as they relate to modeling, simulation and data analysis.
08.0 Develop an understanding of programming languages as they relate to modeling and simulation.
09.0 Demonstrate knowledge of different operating systems.
10.0 Explore software evolution and lifecycle as it relates to modeling and simulation.
11.0 Demonstrate an understanding of visual modeling in relation to the production process.
12.0 Understand the role of texture artists in relation to the production process.
13.0 Demonstrate knowledge of basic materials and textures.
14.0 Demonstrate knowledge of basic lighting.
15.0 Explain visual simulation.
16.0 Explain distributed simulation.
17.0 Explain environmental models.
18.0 Use visual modeling techniques and software to create an environmental model.

For competencies associated with the BTE Core visit the following link: The BTE Core includes the Technical Competencies of the first OCP A of this program.

19.0 Understand the production process of modeling, simulation and entertainment.
20.0 Demonstrate knowledge of basic animation.
21.0 Demonstrate knowledge of basic 3D rendering.
22.0 Demonstrate basic understanding of modeling principles.
23.0 Analyze model fidelity as related to modeling and simulation techniques.
24.0 Explain object models.
25.0 Demonstrate an understanding of mathematical modeling in relation to the production process.
26.0 Explain agent-based simulation.

27.0 Demonstrate knowledge of photo editing software.
28.0 Demonstrate knowledge of video editing software.
29.0 Incorporate audio assets into a modeling and simulation engine.
30.0 Utilize basic audio production techniques, sound construction, and editing techniques as related to modeling and simulation.
31.0 Apply industry standards for 3D animation software and user interface to create 3D basic and complex models.
32.0 Demonstrate knowledge of rigging.
33.0 Demonstrate knowledge of basic character setup.
34.0 Demonstrate knowledge of motion capture systems.
35.0 Use the production process and relevant modeling and simulation techniques and software to design simple 3D simulation.
36.0 Methods and strategies for using Florida Standards for grades 11-12 reading in Technical Subjects for student success in Modeling and Simulation.
37.0 Methods and strategies for using Florida Standards for grades 11-12 writing in Technical Subjects for student success in Modeling and Simulation.
38.0 Methods and strategies for using Florida Standards for grades 11-12 Mathematical Practices in Technical Subjects for student success in Modeling and Simulation.
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 Demonstrate an understanding of 3D modeling and simulation software engines.
43.0 Understand systems engineering for simulators.
44.0 Use real time technology to model and simulate environments.
45.0 Demonstrate an understanding of underlying principles of numerical analysis and how it relates to modeling and simulation.
46.0 Analyze numerical characteristics of univariate data sets to describe patterns and departure from patterns, using statistics for various distributions.
47.0 Use probabilities (relative frequency and theoretical), to plan and conduct an experiment that will address control, randomization and measurement of experimental error.
48.0 Use programming to develop modeling and simulation applications.
49.0 Test programs related to modeling and simulation.
50.0 Perform program maintenance to troubleshoot and optimize code.
51.0 Plan program design using object oriented programming (OOP) for modeling and simulation.
52.0 Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling.
53.0 Demonstrate knowledge of polygon modeling.
54.0 Demonstrate knowledge of animation principles as it relates to the underlying physics of modeling.
55.0 Use the production process and relevant modeling and simulation techniques and software to render a complex 3D simulation.
56.0 Explain and utilize project management and logistics to create and develop 3D modeling and simulation products.
57.0 Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets.
58.0 Apply the principles of entrepreneurism to Modeling and Simulation and demonstrate an understanding of the design and production of prototypes from conception to mass production.
59.0 Use innovative technologies to create prototypes of models.
60.0 Create and design vector or bitmap art reference to develop a 3D modeling texture map to build a model for simulation.

61.0 Demonstrate the use of experimental and engineering design techniques to produce real world or industry simulations.
62.0 Demonstrate an understanding of underlying principles of discreet event simulation and how it relates to modeling and simulation.
63.0 Implement multimedia programming as it relates to modeling and simulation using a gaming engine.
64.0 Use innovative technologies to create prototypes of models.

2015 – 2016

Florida Department of Education
Student Performance Standards

Course Title: **Modeling and Simulation Foundations**
Course Number: **9005210**
Course Credit: **1**

Course Description:

This course provides an overview of the development and expansion of the field of Modeling and Simulation and its impact on society and industry. Strategies, processes and methods for conceptualizing modeling and simulation are introduced to serve as a foundation to cultivate interest and introduce technology skills and knowledge necessary for careers in modeling and simulation.

Hands-on activities using an entry-level modeling and simulation development tool (i.e. Auto Desk, Solid Works or other comparable software) should be integrated into the curriculum. **Regardless of topic sequencing, the culminating activity is the creation of a visual model to aide in the development of a professional portfolio.**

Florida Standards			Correlation to CTE Program Standard #
01.0	Methods and strategies for using Florida Standards for grades 09-10 reading in Technical Subjects for student success in Modeling and Simulation.		
	01.01 Key Ideas and Details		
		01.01.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. LAFS.910.RST.1.1	
		01.01.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. LAFS.910.RST.1.2	
		01.01.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. LAFS.910.RST.1.3	
	01.02 Craft and Structure		

	01.02.1	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics. LAFS.910.RST.2.4	
	01.02.2	Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). LAFS.910.RST.2.5	
	01.02.3	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. LAFS.910.RST.2.6	
01.03	Integration of Knowledge and Ideas		
	01.03.1	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. LAFS.910.RST.3.7	
	01.03.2	Assess the extent to which the reasoning and evidence in a text supports the author's claim or a recommendation for solving a scientific or technical problem. LAFS.910.RST.3.8	
	01.03.3	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. LAFS.910.RST.3.9	
01.04	Range of Reading and Level of Text Complexity		
	01.04.1	By the end of grade 9, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] in the grades 9–10 text complexity band proficiently, with scaffolding as needed at the high end of the range.	
	01.04.2	By the end of grade 10, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] at the high end of the grades 9–10 text complexity band independently and proficiently. LAFS.910.RST.4.10	
02.0	Methods and strategies for using Florida Standards for grades 09-10 writing in Technical Subjects for student success in Modeling and Simulation.		
02.01	Text Types and Purposes		
	02.01.1	Write arguments focused on discipline-specific content. LAFS.910.WHST.1.1	

	02.01.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. LAFS.910.WHST.1.2	
02.02	Production and Distribution of Writing		
	02.02.1	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. LAFS.910.WHST.2.4	
	02.02.2	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. LAFS.910.WHST.2.5	
	02.02.3	Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. LAFS.910.WHST.2.6	
02.03	Research to Build and Present Knowledge		
	02.03.1	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. LAFS.910.WHST.3.7	
	02.03.2	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. LAFS.910.WHST.3.8	
	02.03.3	Draw evidence from informational texts to support analysis, reflection, and research. LAFS.910.WHST.3.9	
02.04	Range of Writing		
	02.04.1	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. LAFS.910.WHST.4.10	
03.0	Methods and strategies for using Florida Standards for grades 09-10 Mathematical Practices in Technical Subjects for student success in Modeling and Simulation.		

	03.01	Make sense of problems and persevere in solving them. MAFS.K12.MP.1.1	
	03.02	Reason abstractly and quantitatively. MAFS.K12.MP.2.1	
	03.03	Construct viable arguments and critique the reasoning of others. MAFS.K12.MP.3.1	
	03.04	Model with mathematics. MAFS.K12.MP.4.1	
	03.05	Use appropriate tools strategically. MAFS.K12.MP.5.1	
	03.06	Attend to precision. MAFS.K12.MP.6.1	
	03.07	Look for and make use of structure. MAFS.K12.MP.7.1	
	03.08	Look for and express regularity in repeated reasoning. MAFS.K12.MP.8.1	

Abbreviations:
MA/LA-FS = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks			MA/LA-FS	NGSSS-Sci
04.0		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:	LAFS.910.L.3.4, LAFS.910.L.3.6,	
	04.01	Define and explain essential modeling and simulation terms and concepts.		
	04.02	Identify disciplines which use modeling and simulation tools and discuss their real world applications.		
	04.03	Identify modeling and simulation related careers and the educational and professional requirements for various fields.		
	04.04	Compare and contrast the central modeling and simulation concepts and careers.		
	04.05	Explain the past, present, and future importance of modeling and simulation.		
05.0		Demonstrate information fluency using emerging research techniques and technology. The student will be able to:	LAFS.910.W.3.7, LAFS.910.W.3.8, LAFS.910.W.3.9, LAFS.910.W.4.10, LAFS.910.L.2.3	

	05.01	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.).		
	05.02	Analyze internet safety issues and practice procedures for complying with acceptable use standards.		
	05.03	Use technology tools to collaborate and generate a deliverable product.		
	05.04	Develop and display an electronic portfolio.		
	05.05	Demonstrate research skills using browsers, search engines, directories, and databases.		
	05.06	Create and evaluate a list of materials found online for relevance, appropriateness and bias.		
	05.07	Create and communicate a multimedia presentation, including text, sound, and graphics as related to modeling and simulation concepts.		
	05.08	Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, Bing.).		
	05.09	Identify effective Boolean search strategies.		
	05.10	Correlate the use of social media in the field of modeling and simulation for a variety of purposes.		
	05.11	Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf).		
06.0	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:		LAFS.910.RI.1.1, LAFS.910.RI.1.2	SC.912.N.4, SC.912.N.4.1
	06.01	Explain how information technology and modeling and simulation impact the operation and management of business and society.		
	06.02	Explain the emergence of e-commerce and e-government and the potential impact on business and society.		
	06.03	Trace the evolution of the Internet from its inception to the present and into the future.		
	06.04	Analyze physical models and organize them conceptually based on their development and historical relevance.		
	06.05	Use graphic technology to create a visualization of a historic simulator or synthetic environment that has evolved over time.		
	06.06	Describe the evolution of the digital computer as it relates to modeling and simulation.		
	06.07	Explain the need for and use of input devices and displays to design and create models and simulations.		
	06.08	Demonstrate an understanding of storage management (e.g., hard drive, floppy disk) as it relates to creating and storing digital models and simulations.		

	06.09 Identify the advantages and limitations of computer-generated models and simulation.		
07.0	Explain intelligent systems as they relate to modeling, simulation and data analysis. The student will be able to:		
	07.01 Define intelligent system.		
	07.02 Explain and examine structured logic and semantics.		
	07.03 Explain the use of intelligent systems.		
	07.04 Examine programs using the elements of an intelligent system.		
08.0	Develop an understanding of programming languages as they relate to modeling and simulation. The student will be able to:		
	08.01 Explain the history of programming languages.		
	08.02 Explain how compilers work.		
	08.03 Identify the three types of programming design approaches (e.g., top-down, structured and object-oriented).		
09.0	Demonstrate knowledge of different operating systems. The student will be able to:		
	09.01 Explain the history and purpose of various operating systems (e.g., DOS, Windows, Mac, and Unix/Linux).		
	09.02 Discuss the impact of RAM and ROM technology on the development of the modern computer operating systems and microcomputers.		
	09.03 Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).		
	09.04 Identify the internal components of a computer (e.g., power supply, hard drive, mother board, input/output (I/O) cards/ports, cabling)..		
	09.05 Identify the different control systems for simulations		
	09.06 Explain the factors that can limit the simulation capabilities of personal computers.		
10.0	Explore software evolution and lifecycle as it relates to modeling and simulation. The student will be able to:		
	10.01 Explain software and hardware lifecycles and their steps.		
	10.02 Demonstrate an understanding of the basic concepts of computer maintenance, upgrades and life cycles.		SC. 912.N.3.5
11.0	Demonstrate an understanding of visual modeling in relation to the production process. The student will be able to:		
	11.01 Explain visual modeling as a process.		
	11.02 Explain the role of a modeler in visual modeling.		
	11.03 Identify job titles associated with visual modeling.		
	11.04 Explain the modeling production pipeline as it relates to visual modeling.		
12.0	Understand the role of texture artists in relation to the production process. The student will be able to:		
	12.01 Define texturing as a process.		

	12.02 Define the role of texture artist.		
	12.03 Identify job titles associated with texture artist.		
	12.04 Identify texture creation in the production pipeline.		
	12.05 Demonstrate knowledge of the difference between textures and shades.		
13.0	Demonstrate knowledge of basic materials and textures. The student will be able to:		
	13.01 Demonstrate an understanding of material and texture storage.		
	13.02 Apply textures to an object.		
	13.03 Demonstrate an understanding of procedural shaders.		
	13.04 Demonstrate an understanding of channels.		
	13.05 Adjust the transparency, luminance, and reflection of a material.		
	13.06 Demonstrate an understanding of displacement maps.		
	13.07 Demonstrate an understanding of bump maps.		
	13.08 Demonstrate knowledge of material projections.		
	13.09 Demonstrate an understanding of UV mapping.		
	13.10 Demonstrate an understanding of 3D painting.		
	13.11 Understand how light affects the look of materials.		
	13.12 Understand how camera angles can affect the look of materials.		
14.0	Demonstrate knowledge of basic lighting. The student will be able to:		
	14.01 Compare and contrast real lighting with 3D lighting.		
	14.02 Demonstrate an understanding of 3 point lighting (key, fill, back).		
	14.03 Demonstrate an understanding of low-key and high-key lighting.		
	14.04 Use include/exclude commands to target light on objects.		
	14.05 Demonstrate use of negative intensity.		SC.912.P.10.19
15.0	Explain visual simulation. The student will be able to:		
	15.01 Define and explain uses of visual simulation.		
	15.02 Explain the use of visual simulation in distributed simulation.		
	15.03 Explain the functions of the image generators, display and databases to support visual subsystem of simulators.		
16.0	Explain distributed simulation. The student will be able to:		
	16.01 Explain networking concepts.		
	16.02 Explain distributed simulation protocols.		
	16.03 Explain the major components in a networked simulation or model.		
17.0	Explain environmental models. The student will be able to:	MAFS.912.F-E.1.1 MAFS.912.F-E.1.2	SC.912.L.18.12 SC.912.E.5.2 SC.912.N.4.2 SC.912.E.5.8 SC.912.L.17
	17.01 Explain the use of environmental modeling.		

	17.02 Discuss how to model environmental effects.		
	17.03 Discuss the effects of environmental simulations on related simulations.		
	17.04 Examine environmental models available on the internet.		
18.0	Use visual modeling techniques and software to create an environmental model. The student will be able to:	LAFS.910.W.3.7, LAFS.910.W.3.8, LAFS.910.W.3.9, LAFS.910.W.4.10, LAFS.910.L.2.3	
	18.01 Demonstrate information fluency by conducting research need to create an environmental model.		
	18.02 Use modeling techniques and software to create a basic environmental model.		
	18.03 Communicate the relevance of the model and its impact on the real world.		

BTE Core:

The first course recommended in this program is a selection from the BTE Core (**Applied Computer Business Skills I and II, or Computing for College and Careers, or Introduction to Information Technology).** The course selections and their descriptions are located here: BTE Core
Student course enrollment in the BTE Core, as with all other secondary courses, requires the reporting if a program in which the student is enrolled. The BTE Core is not an independent program, but a selection of courses for the initial OCP of a program. Student enrollment in BTE Core cannot be reported without an accompanying program number. Teacher certification and other information regarding the BTE Core is identified by the program in which the student is enrolled. See the selected program framework for the appropriate information.

2015 – 2016

Florida Department of Education
Student Performance Standards

Course Title: Modeling and Simulation Design
Course Number: 9005220
Course Credit: 1

Course Description:

This course explores the fundamental principles of modeling and simulation design and application including modeling principles, 3D software, problem analysis, problem solving and its implications for meeting the needs of industry and society.
Hands-on activities using an entry-level modeling and simulation development tool (i.e. Auto Desk, Solid Works or other comparable software) should be integrated into the curriculum. **Regardless of topic sequencing, the culminating activity is the creation of a simple 3D simulation design to aid in the development of a professional portfolio.**

Florida Standards			Correlation to CTE Program Standard #
01.0	Methods and strategies for using Florida Standards for grades 09-10 reading in Technical Subjects for student success in Modeling and Simulation.		
	01.01 Key Ideas and Details		
		01.01.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. LAFS.910.RST.1.1	
		01.01.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. LAFS.910.RST.1.2	

	01.01.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. LAFS.910.RST.1.3	
01.02	Craft and Structure		
	01.02.1	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 09–10 texts and topics. LAFS.910.RST.2.4	
	01.02.2	Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). LAFS.910.RST.2.5	
	01.02.3	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. LAFS.910.RST.2.6	
01.03	Integration of Knowledge and Ideas		
	01.03.1	Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. LAFS.910.RST.3.7	
	01.03.2	Assess the extent to which the reasoning and evidence in a text supports the author's claim or a recommendation for solving a scientific or technical problem. LAFS.910.RST.3.8	
	01.03.3	Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts. LAFS.910.RST.3.9	
01.04	Range of Reading and Level of Text Complexity		
	01.04.1	By the end of grade 9, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] in the grades 9–10 text complexity band proficiently, with scaffolding as needed at the high end of the range.	
	01.04.2	By the end of grade 10, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] at the high end of the grades 9–10 text complexity band independently and proficiently. LAFS.910.RST.4.10	

02.0	Methods and strategies for using Florida Standards for grades 09-10 writing in Technical Subjects for student success in Modeling and Simulation.		
	02.01	Text Types and Purposes	
		02.01.1 Write arguments focused on discipline-specific content. LAFS.910.WHST.1.1	
		02.01.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. LAFS.910.WHST.1.2	
	02.02	Production and Distribution of Writing	
		02.02.1 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. LAFS.910.WHST.2.4	
		02.02.2 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. LAFS.910.WHST.2.5	
		02.02.3 Use technology, including the Internet, to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. LAFS.910.WHST.2.6	
	02.03	Research to Build and Present Knowledge	
		02.03.1 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. LAFS.910.WHST.3.7	
		02.03.2 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. LAFS.910.WHST.3.8	
		02.03.3 Draw evidence from informational texts to support analysis, reflection, and research. LAFS.910.WHST.3.9	
	02.04	Range of Writing	

	02.04.1	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. LAFS.910.WHST.4.10	
03.0	Methods and strategies for using Florida Standards for grades 09-10 Mathematical Practices in Technical Subjects for student success in Modeling and Simulation.		
	03.01	Make sense of problems and persevere in solving them. MAFS.K12.MP.1.1	
	03.02	Reason abstractly and quantitatively. MAFS.K12.MP.2.1	
	03.03	Construct viable arguments and critique the reasoning of others. MAFS.K12.MP.3.1	
	03.04	Model with mathematics. MAFS.K12.MP.4.1	
	03.05	Use appropriate tools strategically. MAFS.K12.MP.5.1	
	03.06	Attend to precision. MAFS.K12.MP.6.1	
	03.07	Look for and make use of structure. MAFS.K12.MP.7.1	
	03.08	Look for and express regularity in repeated reasoning. MAFS.K12.MP.8.1	

Abbreviations:

MA/LA-FS = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		MA/LA-FS	NGSSS-Sci
19.0	Understand the production process of modeling, simulation and entertainment. The student will be able to:	LAFS.910.L.2.3, LAFS.910.L.3.4, LAFS.910.L.3.6 LAFS.910.W.1.2, LAFS.910.W.2.4, LAFS.910.W.2.5, LAFS.910.W.2.6 LAFS.910.W.3.7, LAFS.910.W.3.8, LAFS.910.W.3.9, LAFS.910.W.4.10	

	19.01 Identify the job titles associated with animation and simulation production.		
	19.02 Identify various tools and equipment used to produce 3D animation.		
	19.03 Understand speed and efficiency concepts.		
	19.04 Understand a production pipeline.		
	19.05 Identify the departments of an animation studio.		
	19.06 Understand the interrelationships among departments.		
	19.07 Understand basic communication concepts (verbal, memos, paperwork).		
	19.08 Identify the stages of production.		
	19.09 Understand studio terms and jargon.		
	19.10 Create and organize production paperwork into design/production documentation.		
	19.11 Identify target audiences, markets, and demographics.		
	19.12 Demonstrate ability to write a professionally formatted script.		
	19.13 Demonstrate ability to breakdown a script into production elements (cast, props).		
	19.14 Demonstrate understanding of visual storytelling and how storyboards are used during production.		
20.0	Demonstrate knowledge of basic animation. The student will be able to:		
	20.01 Apply animation principles to object animation.		
	20.02 Demonstrate an understanding of animation timelines.		
	20.03 Demonstrate an understanding of key framing.		
	20.04 Record and edit key frames.		
	20.05 Demonstrate an understanding in the use of controllers.		
	20.06 Render basic reference animation.		
21.0	Demonstrate knowledge of basic 3D rendering. The student will be able to:		
	21.01 Demonstrate an understanding of processor, hardware and software rendering techniques.		
	21.02 Determine the final render format (size, codec, quality).		
	21.03 Demonstrate an understanding of basic render settings.		
	21.04 Select the range of frames to be rendered.		
22.0	Demonstrate basic understanding of modeling principles. The student will be able to:		
	22.01 Understand 3D construction theory.		
	22.02 Demonstrate an understanding of primitives and parametric modeling.		
	22.03 Demonstrate an understanding of non-uniform rational basis spline (NURBS), splines, and polygonal modeling.		
	22.04 Demonstrate the ability to use reference images and files while modeling.		
23.0	Analyze model fidelity as related to modeling and simulation techniques. The student will be able to:		
	23.01 Define fidelity.		
	23.02 Discuss the ramifications of model fidelity parameters and their variations.		

	23.03 Select the proper level of fidelity to solve a given problem.		
	23.04 Identify the rationale for selecting fidelity level.		
	23.05 Adjust model fidelity parameters to meet output requirements.		
24.0	Explain object models. The student will be able to:		
	24.01 Describe objects using object oriented design (OOD).		
	24.02 Distinguish between abstract and real objects.		
	24.03 Explain why object oriented design is an effective programming paradigm.		
	24.04 Implement classes and methods.		
	24.05 Describe the benefits of object oriented concepts.		
	24.06 Describe object oriented design (OOD) using pseudo-code or Unified Modeling Language (UML).		
25.0	Demonstrate an understanding of mathematical modeling in relation to the production process. The student will be able to:	MAFS.912.A-REI.1.1	
	25.01 Explain mathematical modeling as processes.		
	25.02 Explain the role of modeler in mathematical modeling.		
	25.03 Identify job titles associated with mathematical modeling.		
	25.04 Explain the modeling production pipeline as it relates to mathematical modeling.		
26.0	Explain agent-based simulation. The student will be able to:		
	26.01 Demonstrate the concept of a distributed environment.		
	26.02 Explore the architecture of agent-based simulation.		
	26.03 Demonstrate the uses of agent-based modeling.		
27.0	Demonstrate knowledge of photo editing software. The student will be able to:		
	27.01 Demonstrate understanding file formats and storage options.		
	27.02 Identify parts of the software interface (menus/palettes).		
	27.03 Demonstrate ability to use each of the basic tool sets.		
	27.04 Demonstrate ability to import, export and save images.		
	27.05 Demonstrate understanding of layers and channels.		
	27.06 Demonstrate understanding of filters, effects and plug-ins.		
	27.07 Demonstrate understanding of file presets.		
	27.08 Demonstrate ability to select portions of an image for manipulation.		
	27.09 Demonstrate ability to transform selections and images (crop, scale).		
	27.10 Demonstrate ability to color correct images (brightness, hue, contrast).		
	27.11 Demonstrate ability to use brushes for image creation and correction.		
	27.12 Understand non-destructive and destructive operations.		
	27.13 Demonstrate the ability to import, paint and export 3D objects.		
28.0	Demonstrate knowledge of video editing software. The student will be able to:	MAFS.912.G-GMD.2.4	
	28.01 Demonstrate understanding file formats and storage options.		

	28.02 Identify parts of the software interface (menus/palettes).		
	28.03 Demonstrate ability to use each of the basic tool sets.		
	28.04 Demonstrate ability to import, export and save video.		
	28.05 Demonstrate understanding of layers and compositing.		
	28.06 Demonstrate understanding of filters, effects and plug-ins.		
	28.07 Demonstrate understanding of file presets.		
	28.08 Demonstrate understanding of rendering process.		
	28.09 Demonstrate ability to transform video (crop, scale).		
	28.10 Demonstrate ability to color correct images (brightness, hue, contrast).		
	28.11 Demonstrate ability to use brushes for image creation and correction.		
	28.12 Understand non-destructive and destructive operations.		
	28.13 Demonstrate the compositing integration of rendered 3D animation with video.		
29.0	Incorporate audio assets into modeling and simulation engine. The student will be able to:		
	29.01 Describe the audio effects workflow.		
	29.02 Explain audio codecs and formats used in game/simulation engines.		
	29.03 Import audio into the game/simulation engine.		
	29.04 Use appropriate naming conventions for audio assets.		
	29.05 Describe the use of 3D and surround sound.		
	29.06 Apply knowledge of distance/spatial effects, including surround sound, in a game/ simulation.		
	29.07 Analyze the relationship of the audio environment to the visual environment.		
30.0	Utilize basic audio production techniques, sound construction, and editing techniques as related to modeling and simulation. The student will be able to:		
	30.01 Describe the use of digital recording decks and other digital storage devices.		
	30.02 Describe the function and operation of digital audio workstations.		
	30.03 Edit, cut, erase, and insert sound utilizing various digital production techniques.		
	30.04 Perform digital noise reduction and noise extraction via spectral display.		
	30.05 Survey and discuss the use of naming conventions and temp sounds.		
	30.06 Demonstrate an understanding of various audio construction software.		
	30.07 Analyze and discuss methods of matching sound effects to art assets.		
	30.08 Identify and categorize commonly used technology sound engine integration equipment.		
	30.09 Identify and discuss resources such as sound effects libraries.		
	30.10 Examine methods of sound implementation and associated software.		
	30.11 Explain how and why digital video may be integrated into a model or simulation design.		
	30.12 Explain the roles and responsibilities of the sound design team.		

31.0	Apply industry standards for 3D animation software and user interface to create 3D simple and complex models. The student will be able to:		
	31.01 Identify the computer requirements for 3D animation software.		
	31.02 Compare and contrast available 3D animation software.		
	31.03 Identify available file formats and protocols.		
	31.04 Explain the cinematic stage paradigm in 3D software.		
	31.05 Demonstrate an understanding of naming conventions.		
	31.06 Develop software and file backup plan.		
	31.07 Identify common icons within the software.		
	31.08 Demonstrate use of keyboard shortcuts.		
	31.09 Understand the use of a three-button mouse.		
	31.10 Identify the main windows of a 3D program.		
	31.11 Identify common window layouts.		
	31.12 Identify tool icons within the software.		
	31.13 Understand the significance of keyboard shortcut use and efficiency.		
	31.14 Demonstrate an understanding of the Euclidean Geometry Model (x-y-z coordinate system).		
	31.15 Demonstrate an understanding of attribute managers.		
	31.16 Demonstrate an understanding of layers.		
	31.17 Navigate the modeling window using pan, rotate, and zoom controls.		
	31.18 Demonstrate knowledge of selection tools (lasso, loop).		
	31.19 View objects in wireframe, gourard shading, lines, boxes and modes.		
	31.20 Demonstrate use of selection sets.		
	31.21 Undo and redo an action within the program.		
	31.22 Locate the help menu system.		
32.0	Demonstrate knowledge of rigging. The student will be able to:		
	32.01 Define rigging as a process.		
	32.02 Define the role of rigger.		
	32.03 Identify job titles associated with a rigger.		
	32.04 Identify rigging creation in the production pipeline.		
33.0	Demonstrate knowledge of basic character setup. The student will be able to:		
	33.01 Compare and contrast rigging approaches and styles.		
	33.02 Demonstrate an understanding of the rig as it relates to the model.		
	33.03 Demonstrate an understanding of skeletal systems.		
34.0	Demonstrate knowledge of motion capture systems. The student will be able to:		
	34.01 Understand knowledge of the history of motion capture.		
	34.02 Understand the awareness of emerging technologies in the industry.		
	34.03 Understand motion capture for 3D production.		

35.0	Use the production process and relevant modeling and simulation techniques and software to design simple 3D simulation. The student will be able to:	LAFS.910.W.3.7, LAFS.910.W.3.8, LAFS.910.W.3.9, LAFS.910.W.4.10, LAFS.910.L.2.3	
35.01	Demonstrate information fluency by conducting research need to design simple 3D simulation.		
35.02	Use the production process and relevant modeling and simulation techniques and software to design simple 3D simulation.		
35.03	Communicate the relevance of the simulation and its impact on the real world.		

2015 – 2016

Florida Department of Education
Student Performance Standards

Course Title: **Modeling and Simulation Applications**
Course Number: **9005230**
Course Credit: **1**

Course Description:

This course focuses on the acquisition of technology skills for rendering a Modeling and Simulation product, including visual simulation and engineering logistics and implementation issues as they relate to Modeling and Simulation products.

Hands-on activities using an entry-level modeling and simulation development tool (i.e. Auto Desk, Solid Works or other comparable software) should be integrated into the curriculum.

Regardless of topic sequencing, the culminating activity is the rendering of a complex 3D simulation Design to aid in the development of a professional portfolio.

Florida Standards			Correlation to CTE Program Standard #
36.0	Methods and strategies for using Florida Standards for grades 11-12 reading in Technical Subjects for student success in Modeling and Simulation.		
	36.01 Key Ideas and Details		
		36.01.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. LAFS.1112.RST.1.1	
		36.01.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. LAFS.1112.RST.1.2	
		36.01.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. LAFS.1112.RST.1.3	
	36.02 Craft and Structure		

	36.02.1	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. LAFS.1112.RST.2.4	
	36.02.2	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. LAFS.1112.RST.2.5	
	36.02.3	Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. LAFS.1112.RST.2.6	
36.03	Integration of Knowledge and Ideas		
	36.03.1	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g. quantitative data, video, multimedia) in order to address a question or solve a problem. LAFS.1112.RST.3.7	
	36.03.2	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. LAFS.1112.RST.3.8	
	36.03.3	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. LAFS.1112.RST.3.9	
36.4	Range of Reading and Level of Text Complexity		
	36.03.4	By the end of grade 11, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range.	
	36.03.5	By the end of grade 12, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] at the high end of the grades 11–CCR text complexity band independently and proficiently. LAFS.1112.RST.4.10	
37.0	Methods and strategies for using Florida Standards for grades 11-12 writing in Technical Subjects for student success in Modeling and Simulation.		
37.01	Text Types and Purposes		
	37.01.1	Write arguments focused on discipline-specific content. LAFS.1112.WHST.1.1	

	37.01.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. LAFS.1112.WHST.1.2	
37.02	Production and Distribution of Writing		
	37.02.1	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. LAFS.1112.WHST.2.4	
	37.02.2	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. LAFS.1112.WHST.2.5	
	37.02.3	Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. LAFS.1112.WHST.2.6	
37.03	Research to Build and Present Knowledge		
	37.03.1	Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. LAFS.1112.WHST.3.7	
	37.03.2	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. LAFS.1112.WHST.3.8	
	37.03.3	Draw evidence from informational texts to support analysis, reflection, and research. LAFS.1112.WHST.3.9	
37.04	Range of Writing		
	37.04.1	Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. LAFS.1112.WHST.4.10	

38.0	Methods and strategies for using Florida Standards for grades 11-12 Mathematical Practices in Technical Subjects for student success in Modeling and Simulation.	
38.01	Make sense of problems and persevere in solving them. MAFS.K12.MP.1.1	
38.02	Reason abstractly and quantitatively. MAFS.K12.MP.2.1	
38.03	Construct viable arguments and critique the reasoning of others. MAFS.K12.MP.3.1	
38.04	Model with mathematics. MAFS.K12.MP.4.1	
38.05	Use appropriate tools strategically. MAFS.K12.MP.5.1	
38.06	Attend to precision. MAFS.K12.MP.6.1	
38.07	Look for and make use of structure. MAFS.K12.MP.7.1	
38.08	Look for and express regularity in repeated reasoning. MAFS.K12.MP.8.1	

Abbreviations:
MA/LA-FS = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks		MA/LA-FS	NGSSS-Sci
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:	LASFS.1112.SL.2.5	
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:	LAFS.1112.W.1.3	SC.912.N.3.5
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:	MAFS.912.F-IF.2.4 MAFS.912.S-ID.1.1 MAFS.912.S-ID.2.6	SC.912.N.1.1 SC.912.N.3.5
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	Demonstrate an understanding of 3D modeling and simulation software engines. The student will be able to:		SC.912.P.10.2 SC.912.P.12.2, SC.912.P.12.3, SC.912.P.12.5, SC.912.P.12.6
42.01	Understand concepts of the transfer of training.		
42.02	Understand mathematics of physics based real-time simulators.		
42.03	Describe components of visual systems (image generation, data bases and displays).		
42.04	Describe theory of motion/control loading simulation and cue synchronization.		
42.05	Describe trainee station design, sensor simulation and instructor/operator station design.		

	42.06 Understand and utilize collision detection.		
43.0	Understand systems engineering for simulators. The student will be able to:		
	43.01 Understand the systems engineering life cycle process and terminology.		
	43.02 Identify the major milestones in the system life cycle.		
	43.03 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.		
	43.04 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).		
44.0	Use real time technology to model and simulate environments. The student will be able to:		
	44.01 Identify simulator applications.		
	44.02 Identify where team simulators would be appropriate.		
	44.03 Identify where individual simulators would be appropriate.		
	44.04 Understand where and why networked simulators are used.		
45.0	Demonstrate an understanding of underlying principles of numerical analysis and how it relates to modeling and simulation. The student will be able to:	MAFS.912.A-REI.1.1	
	45.01 Apply logical reasoning skills to solve real-world problems through the development of mathematical models.		
	45.02 Design a step-by-step plan (algorithm) to solve a given problem.		
	45.03 Write program specifications that define the constraints of a given problem.		
	45.04 Use a programmable calculator.		
	45.05 Write an algorithm to solve mathematical problems using formulas, equations, and functions.		
46.0	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:	MAFS.912.S-ID.2.3, MAFS.912.S-ID.2.4, MAFS.912.S-ID.2.5, MAFS.912.S-ID.2.6	SC.912.N.2.5
	46.01 Define terminology associated with data collection, statistics and graphing.		
	46.02 Differentiate between the various methods of data collection.		
	46.03 Explain the uses of random number generators.		
	46.04 Recognize various sources of bias in data collection.		
	46.05 Prepare a sample data collection.		
	46.06 Determine the numerical characteristics of a data set and analyze data.		
	46.07 Interpret tables of statistics.		
	46.08 Create bar charts and pie graphs with appropriate software.		
	46.09 Analyze the data to solve a presented problem.		
	46.10 Apply problem analysis using flowcharts or the Unified Modeling Language (UML).		

47.0	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:	MAFS.912.S-CP.1.1, MAFS.912.S-CP.1.2, MAFS.912.S-CP.1.3, MAFS.912.S-CP.1.4, MAFS.912.S-CP.1.5, MAFS.912.S-CP.2.6, MAFS.912.S-CP.2.7, MAFS.912.S-CP.2.8, MAFS.912.S-CP.2.9, MAFS.912.S-MD.1.1, MAFS.912.S-MD 1.2, MAFS.912.S-MD 1.3, MAFS.912.S-MD.1.4, MAFS.912.S-MD 2.5, MAFS.912.S-MD2.6, MAFS.912.S-MD2.7	
	47.01 Define and explain probability rules and event terminology.		
	47.02 Identify events as complementary, dependent, independent, mutually exclusive or not mutually exclusive.		
	47.03 Analyze categorical data using two-way tables to describe patterns and departure from patterns and to find marginal frequency and relative frequencies.		
	47.04 Distinguish between empirical and theoretical probability.		
	47.05 Calculate probabilities.		
	47.06 Explain the law of large numbers.		
	47.07 Calculate probabilities using addition rules.		
	47.08 Calculate probabilities using the multiplications rules.		
	47.09 Define the Fundamental Counting Rule, Permutation, and Combination.		
	47.10 Perform calculations using the Fundamental Counting Rule, Permutation and Combination.		
	47.11 Distinguish when one would use a permutation and when one would use a combination.		
	47.12 Define experimental terminology.		
	47.13 Explain potential reasons for experimental error.		
	47.14 Demonstrate an understanding of the principles of probability by performing a probability experiment within the classroom.		
48.0	Use programming to develop modeling and simulation applications. The student will be able to:		
	48.01 Utilize reference manuals.		
	48.02 Write programs according to recognized programming standards.		
	48.03 Write internal documentation statements as needed in the program source code.		

	48.04 Code programs in high-level languages for game/simulation applications.		
	48.05 Write code that accesses sequential, random, and direct files.		
	48.06 Code programs using logical statements (e.g., If-Then-Else, Do...While).		
	48.07 Enter and modify source code using a program language editor.		
	48.08 Code routines within programs that validate input data.		
	48.09 Use the rounding function in calculations within programs.		
	48.10 Write programs as part of a development team.		
	48.11 Write event-driven programs.		
	48.12 Write programs using timed-event strategies and methodologies.		
	48.13 Write programs that include score keeping.		
	48.14 Write programs that display text.		
	48.15 Write programs that use composite graphic objects.		
	48.16 Write programs that load a bitmap for background.		
	48.17 Write programs that utilize a sprite handler.		
	48.18 Write programs that use animation.		
	48.19 Write programs that use scrolling.		
	48.20 Write programs that use transparency.		
	48.21 Write documentation to assist operators and end-users.		
	48.22 Follow established documentation standards.		
	48.23 Update existing documentation to reflect program changes.		
49.0	Test programs related to modeling and simulation. The student will be able to:		
	49.01 Perform debugging activities.		
	49.02 Evaluate program test results.		
	49.03 Use trace routines of compilers to assist in program debugging.		
	49.04 Compile and run programs.		
	49.05 Create a stable code base.		
	49.06 Develop data for use in program testing.		
	49.07 Distinguish among the different types of program and design errors.		
50.0	Perform program maintenance to troubleshoot and optimize code. The student will be able to:		
	50.01 Review requested modification of programs and establish a plan of action.		
	50.02 Design needed modifications in compliance with established standards.		
	50.03 Code, test, and debug modifications prior to updating production code.		
	50.04 Update production programs and documentation with changes.		
	50.05 Analyze output to identify and annotate errors or enhancements.		
51.0	Plan program design using object oriented programming (OOP) for modeling and simulation. 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 pseudo code to represent the structure in a program or subroutine.		
	51.03 Design programs to solve problems using problem-solving strategies.		
52.0	Demonstrate knowledge of non-uniform rational b-splines (NURBS) modeling. The student will be able to:	MAFS.M12.G-MG.1.1 MAFS.M12.G-MG.1.2, MAFS.M12.G-MG.1.3, MAFS.912.A-REI.3.5	
	52.01 Demonstrate an understanding of points, vertices, edges, and polygons.		
	52.02 Demonstrate an understanding of poly-count.		
	52.03 Demonstrate an understanding of primitives.		
	52.04 Define parametric primitives.		
	52.05 Locate an object's properties, attributes, and coordinates.		
	52.06 Demonstrate understanding of Non uniform rational b-splines (NURBS).		
	52.07 Demonstrate understanding of splines and generators (extrude, lathe, sweep).		
	52.08 Understand the use of hierarchy.		
	52.09 Demonstrate an understanding of Boolean objects.		
	52.10 Demonstrate an understanding of Null objects.		
	52.11 Demonstrate an understanding of scene management (hiding-unhiding).		
	52.12 Demonstrate an understanding of arrays.		
53.0	Demonstrate knowledge of polygon modeling. The student will be able to:		
	53.01 Demonstrate an understanding of N-gons.		
	53.02 Demonstrate an understanding of subdivision.		
	53.03 Demonstrate basic polygon editing and manipulation.		
	53.04 Demonstrate knowledge of point management (location).		
	53.05 Demonstrate the ability to create polygonal models from points.		
	53.06 Demonstrate an understanding of cutting/division tools.		
	53.07 Demonstrate an understanding of extrudes.		
	53.08 Demonstrate an understanding of symmetry.		
	53.09 Demonstrate an understanding of hyper NURBS.		
	53.10 Demonstrate an understanding of basic deformers (bend, twist, melt).		
54.0	Demonstrate knowledge of animation principles as it relates to the underlying physics of modeling. The student will be able to:		
	54.01 Demonstrate an understanding of the principle of squash and stretch.		
	54.02 Demonstrate an understanding of the principle of anticipation.		
	54.03 Demonstrate an understanding of the principle of staging.		
	54.04 Demonstrate an understanding of the principle of straight ahead action and pose to pose.		

	54.05 Demonstrate an understanding of the principle of follow through and overlapping action.		
	54.06 Demonstrate an understanding of the principle of slow in and slow out.		
	54.07 Demonstrate an understanding of the principle of arcs.		
	54.08 Demonstrate an understanding of the principle of secondary action.		
	54.09 Demonstrate an understanding of the principle of timing.		
	54.10 Demonstrate an understanding of the principle of exaggeration.		
	54.11 Demonstrate an understanding of the principle of solid drawing.		
	54.12 Demonstrate an understanding of the principle of appeal.		
55.0	Use the production process and relevant modeling and simulation techniques and software to render a complex 3D simulation. The student will be able to:	LAFS.910.W.3.7, LAFS.910.W.3.8, LAFS.910.W.3.9, LAFS.910.W.4.10, LAFS.910.L.2.3	
	55.01 Demonstrate information fluency by conducting research need to render a complex 3D simulation.		
	55.02 Use the production process and relevant modeling and simulation techniques and software to render a complex 3D simulation.		
	55.03 Communicate the relevance of the simulation and its impact on the real world.		

2015 – 2016

Florida Department of Education
Student Performance Standards

Course Title: **Modeling and Simulation Innovation and Prototyping**
Course Number: **9005240**
Course Credit: **1**

Course Description:

This course provides students with the extended modeling and simulation content and skills essential for innovating, designing and producing prototypes.

Hands-on activities using an entry-level modeling and simulation development tool (i.e. Auto Desk, Solid Works or other comparable software) should be integrated into the curriculum. **Regardless of topic sequencing, the culminating activity is the completion of a capstone project to demonstrate competency in the field of modeling and simulation research, design and practice and to aide in the completion of a professional portfolio.**

Florida Standards	Correlation to CTE Program Standard #
36.0 Methods and strategies for using Florida Standards for grades 11-12 reading in Technical Subjects for student success in Modeling and Simulation.	
36.1 Key Ideas and Details	
36.1.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. LAFS.1112.RST.1.1	
36.1.2 Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. LAFS.1112.RST.1.2	
36.1.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. LAFS.1112.RST.1.3	
36.2 Craft and Structure	

	36.2.1 Determine the meaning of symbols key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics. LAFS.1112.RST.2.4	
	36.2.2 Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. LAFS.1112.RST.2.5	
	36.2.3 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. LAFS.1112.RST.2.6	
36.3	Integration of Knowledge and Ideas	
	36.3.1 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g. quantitative data, video, multimedia) in order to address a question or solve a problem. LAFS.1112.RST.3.7	
	36.3.2 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. LAFS.1112.RST.3.8	
	36.3.3 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. LAFS.1112.RST.3.9	
36.4	Range of Reading and Level of Text Complexity	
	36.4.1 By the end of grade 11, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] in the grades 11–CCR text complexity band proficiently, with scaffolding as needed at the high end of the range. 36.4.2 By the end of grade 12, read and comprehend literature [informational texts, history/social studies texts, science/technical texts] at the high end of the grades 11–CCR text complexity band independently and proficiently. LAFS.1112.RST.4.10	
37.0	Methods and strategies for using Florida Standards for grades 11-12 writing in Technical Subjects for student success in Modeling and Simulation.	
37.1	Text Types and Purposes	
	37.1.1 Write arguments focused on discipline-specific content. LAFS.1112.WHST.1.1	

	37.1.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. LAFS.1112.WHST.1.2	
37.2	Production and Distribution of Writing	
	37.2.1 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. LAFS.1112.WHST.2.4	
	37.2.2 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. LAFS.1112.WHST.2.5	
	37.2.3 Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. LAFS.1112.WHST.2.6	
37.3	Research to Build and Present Knowledge	
	37.3.1 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. LAFS.1112.WHST.3.7	
	37.3.2 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. LAFS.1112.WHST.3.8	
	37.3.3 Draw evidence from informational texts to support analysis, reflection, and research. LAFS.1112.WHST.3.9	
37.4	Range of Writing	
	37.4.1 Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. LAFS.1112.WHST.4.10	
38.0 Methods and strategies for using Florida Standards for grades 11-12 Mathematical Practices in Technical Subjects for student success in Modeling and Simulation.		

	38.1	Make sense of problems and persevere in solving them. MAFS.K12.MP.1.1	
	38.2	Reason abstractly and quantitatively. MAFS.K12.MP.2.1	
	38.3	Construct viable arguments and critique the reasoning of others. MAFS.K12.MP.3.1	
	38.4	Model with mathematics. MAFS.K12.MP.4.1	
	38.5	Use appropriate tools strategically. MAFS.K12.MP.5.1	
	38.6	Attend to precision. MAFS.K12.MP.6.1	
	38.7	Look for and make use of structure. MAFS.K12.MP.7.1	
	38.8	Look for and express regularity in repeated reasoning. MAFS.K12.MP.8.1	

Abbreviations:
MA/LA-FS = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

CTE Standards and Benchmarks			MA/LA-FS	NGSSS-Sci
56.0		Explain and utilize project management and logistics to create and develop 3D modeling and simulation products. The student will be able to:		
	56.01	Explain the process groups and knowledge areas that comprise the Project Management body of knowledge using appropriate PMBOK terminology.		
	56.02	Define the roles of a Project Manager and stakeholders.		
	56.03	Discuss the project life cycle and scope.		
	56.04	Create a work breakdown structure (WBS) making estimates of the required work durations and resource allocations using a performance measurement baseline (PMB) for a project.		
	56.05	Brainstorm potential risks and develop a risk management plan for the project.		

57.0	Understand the implications of intellectual property rights, copyright laws and plagiarism on creative assets. The student will be able to:	LAFS.1112.SL.2.4, LAFS.1112.SL.2.5 LAFS.1112.W.1.2, LAFS.1112.W.2.4, LAFS.1112.W.2.5, LAFS.1112.W.2.6 LAFS.1112.W.3.7, LAFS.1112.W.3.8, LAFS.1112.W.4.10	
	57.01 Practice ethical behaviors regarding copyright, citation, and plagiarism.		
	57.02 Understand the process of patent application filing, product trials, and communication techniques to describe their product.		
	57.03 Explain the purposes of copyrights, trademarks, and patents and understand the limitations and expectations.		
	57.04 Explore and examine components of intellectual property such as patents, copyrights, trademarks, and trade secrets.		
	57.05 Understand “Fair Use and Fair Dealing” practices.		
	57.06 Understand the transfer and licensing of creative works.		
	57.07 Understand the use of “exclusive rights” to intellectual creations.		
	57.08 Utilize digital watermarking.		
58.0	Apply the principles of entrepreneurism 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:	LAFS.1112.SL.2.4, LAFS.1112.SL.2.5 LAFS.1112.W.1.2, LAFS.1112.W.2.4, LAFS.1112.W.2.5, LAFS.1112.W.2.6 LAFS.1112.W.3.7, LAFS.1112.W.3.8, LAFS.1112.W.4.10	
	58.01 Identify the usefulness of technology applications.		
	58.02 Determine the design architecture.		
	58.03 Formulate and test a proof of concept.		
	58.04 Understand the value of partnerships and sub-contracting of production and distribution of product.		
	58.05 Develop an understanding of the production process.		
	58.06 Understand return on investment (ROI) concepts.		
	58.07 Examine market analysis of product.		
	58.08 Develop a comprehensive business model and present a clear and professional proposal to investors.		

59.0	Use innovative technologies to create prototypes of models. The student will be able to:		
59.01	Identify emerging technologies to develop prototypes.		
59.02	Compare and contrast the benefits and limitations of using various prototyping methods and costs.		
59.03	Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).		
60.0	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:	MAFS.912.G-MG.1, MAFS.912.N-VM.1, MAFS.912.G-GMD2.4, MAFS912.G-MG.1.1, MAFS912.G-MG1.3 MAFS.912.G-GMD.2.4	SC.912.P.12.1
60.01	Know the difference between vectors and bitmaps.		
60.02	Demonstrate an understanding of various 2D art programs.		
60.03	Utilize the programs tools and brushes.		
60.04	Know the importance of layers.		
60.05	Identify file formats.		
60.06	Use digital media software to create a vector of bitmap reference object.		
60.07	Import a reference object into 3D modeling software.		
60.08	Convert a reference object to 3D.		
60.09	Create simple texture in/with a bitmap program.		
61.0	Demonstrate the use of experimental and engineering design techniques to produce real world or industry simulations. The students will be able to:	MAFS.912.F-BF.1.1, MAFS.912.F-BF.1.2 LAFS.1112.RL.3.7	
61.01	Understand the design requirements and limitations of a 2D modeling and simulation engine.		
61.02	Demonstrate the use of various mediums and mixed media (traditional or digital) in a 2D modeling and simulation.		
61.03	Demonstrate the ability to create character and object views for animation.		
61.04	Break down animation into a series of pictures to import animation to a modeling and simulation engine.		
61.05	Demonstrate the effective use of animation loops and cycles in a modeling and simulation engine.		
61.06	Demonstrate an understanding of the value of timing to convey character motion.		
61.07	Demonstrate the effective use of animation arcs for the articulation of body elements.		
61.08	Demonstrate the use of principles of animation such as anticipation, squash, stretch, weight, exaggeration and overlapping and secondary motion.		
61.09	Demonstrate the use of phonemes to display speech in animation.		

62.0	Demonstrate an understanding of underlying principles of discreet event simulation and how it relates to modeling and simulation. The student will be able to:	MAFS.912.S-ID1.1, MAFS.912.S-ID1.2, MAFS.912.S-ID1.3, MAFS.912.S-ID1.4	
	62.01 Identify discrete event simulations.		
	62.02 Use simulation as an analysis tool.		
	62.03 Describe the output distribution.		
	62.04 Use historical/empirical data.		
	62.05 Interpret summary statistics.		
	62.06 Interpret confidence and prediction (certainty) intervals.		
	62.07 Identify sources and impact of error in simulations.		
	62.08 Describe relationships among variables.		
	62.09 Describe the effect of correlation on simulation results.		
63.0	Implement multimedia programming as it relates to modeling simulation using a gaming engine. The student will be able to:		
	63.01 Demonstrate proficiency in creating multiple composite objects.		
	63.02 Demonstrate proficiency in moving composite graphics objects.		
	63.03 Demonstrate proficiency in rotating composite graphics objects manually.		
	63.04 Distinguish between flock and flee artificial intelligence algorithms.		
	63.05 Write programs that use blitting.		
	63.06 Identify the basic constructs used in bounding box collision algorithms.		
	63.07 Identify the basic constructs used in truer bounding box collisions.		
	63.08 Demonstrate proficiency in creating a bouncing simulation.		
	63.09 Simulate pattern-based movement.		
	63.10 Simulate multiple sprites movement.		
	63.11 Identify the basic constructs used in keyboard input.		
	63.12 Identify the basic constructs used in mouse input.		
	63.13 Identify the basic constructs used in double buffering.		
64.0	Use innovative technologies to create prototypes of models. The student will be able to:		
	64.01 Identify emerging technologies to develop prototypes.		
	64.02 Compare and contrast the benefits and drawbacks of using various prototyping methods and costs.		
	64.03 Use emerging technologies to create a prototype (i.e. 3D printing software, 3D printers or other applicable devices).		

Abbreviations:
FS-M/LA = Florida Standards for Math/Language Arts
NGSSS-Sci = Next Generation Sunshine State Standards for Science

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

The occupational standards and benchmarks outlined in this secondary program correlate to the standards and benchmarks of the postsecondary program with the same Classification of Instructional Programs (CIP) number.

Career and Technical Student Organization (CTSO)

Future Business Leaders of America (FBLA) and Business Professionals of America (BPA) are the intercurricular career and technical student organizations providing leadership training and reinforcing specific career and technical skills for secondary students. 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.

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. 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.

In addition to accommodations, some secondary students with disabilities (students with an IEP served in Exceptional Student Education (ESE)) will need modifications to meet their needs. Modifications change the outcomes or what the student is expected to learn, e.g., modifying the curriculum of a secondary career and technical education course. Note: postsecondary curriculum and regulated secondary programs cannot be modified.

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student

performance standards associated with a regular Occupational Completion Point (OCP) or a Modified Occupational Completion Point (MOCP). If needed, a student may enroll in the same career and technical course more than once. Documentation should be included in the IEP that clearly indicates that it is anticipated that the student may need an additional year to complete an OCP/MOCP. The student should work on different competencies and new applications of competencies each year toward completion of the OCP/MOCP. After achieving the competencies identified for the year, the student earns credit for the course. It is important to ensure that credits earned by students are reported accurately. The district's information system must be designed to accept multiple credits for the same course number for eligible students with disabilities.

Additional Resources

For additional information regarding articulation agreements, Bright Futures Scholarships, Fine Arts/Practical Arts Credit and Equivalent Mathematics and Equally Rigorous Science Courses please refer to:
http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml