Florida Department of Education
Curriculum Framework

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

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 Modeling and Simulation Designer or Software Developer 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 practical experiences in modeling and simulation conceptualization, design, storyboarding, development methodologies, essential programming techniques, and implementation issues. Specialized programming skills involving advanced mathematical calculations and physics are also integrated into the curriculum.

Program Structure

This program is a planned sequence of instruction consisting of three 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. This includes Computing for College & Careers (8209020) or Introduction to Information Technology (8207310). It is also recommended that students complete core courses in advanced mathematics and physics. 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.

When offered at the post secondary level, 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.

Laboratory Activities

Laboratory activities are an integral part of this program. These activities include instruction in the use of safety procedures, tools, equipment, materials, and processes related to these occupations. Equipment and supplies should be provided to enhance hands-on experiences for students.

Special Notes

Program Recommendations

This program is project-based and focuses on broad, transferable skills and stresses understanding and demonstration of the following rudiments of the modeling and simulation industry: production planning, elements of production design, storyboarding, elements of visual design and software, integration of digital audio and digital video into new modeling and simulation productions, programming and collaboration/teamwork.

The Foundations and Design courses should be taken in sequence prior to the Programming and Multi-User Programming courses. The Programming and Multi-User Programming courses may be taken concurrently. It is highly recommended that students complete a programming course prior to taking the last two courses of this program. The BTE core course may be taken concurrently with either the Foundations course or the Design course.

The Programming (8208330) and Multiuser Programming (8208340) courses should be offered with a concentration on one programming language to ensure students are prepared for industry certifications.

The Modeling and Simulation Advanced Applications program is an appropriate follow-on capstone program.

The Modeling and Simulation Programming 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. To achieve total curriculum integration, academic and career and technical education teachers should be scheduled with common planning times.

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 "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.

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

Career and Technical Student Organization (CTSO)

Future Business Leaders of America (FBLA) and Business Professionals of America (BPA) are the appropriate career and technical student organizations for providing leadership training and reinforcing specific career and technical skills to secondary students. For postsecondary students, Phi Beta Lambda and BPA are the appropriate student organizations. 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 program-specific OJT framework apply.

There is a **Cooperative Education Manual** available on-line that has guidelines for students, teachers, employers, parents and other administrators and sample training agreements. It can be accessed on the DOE website at http://www.fldoe.org/workforce/programs/doc/coopm.doc.

Basic Skills

In PSAV 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 10.0, Language 10.0, and Reading 10.0. These grade level numbers correspond to a grade equivalent score obtained on a state designated basic skills examination. Students may be exempt from meeting the Basic Skills requirements by earning an eligible industry certification. See the Basic Skills Exemption List document for a list of eligible industry certifications (http://www.fldoe.org/workforce/dwdframe/rtf/basic-skills.rtf).

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 pursuant to Section 1008.29, F.S.; 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.)

Essential Skills

Essential skills identified by the Division of Career and Adult Education have been integrated into the standards and benchmarks of this program. These skills represent the general knowledge and skills considered by industry to be essential for success in careers across all career clusters. Students preparing for a career served by this program at any level should be able to demonstrate these skills in the context of this program. Links to instructional resources in support of Essential Skills are published on the CTE Essential Skills page of the FL-DOE website (http://www.fldoe.org/workforce/dwdframe/essential_skills.asp).

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's IEP or 504 plan or postsecondary student's accommodations plan 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 postsecondary service provider. 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.

In addition to accommodations, some secondary students with disabilities (ESE) will need modifications to meet their special 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 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(s)/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).

Articulation

The PSAV component of this program has no statewide articulation agreement approved by the Articulation Coordinating Committee. However, this does not preclude the awarding of credits by any college through local agreements.

For details on statewide articulation agreements which correlate to programs and industry certifications, refer to http://www.fldoe.org/workforce/dwdframe/artic_frame.asp.

Bright Futures/Gold Seal Scholarship

Course substitutions as defined in the Comprehensive Course Table for this program area may be used to qualify a student for Florida's Gold Seal Vocational Scholarship, providing all other eligibility requirements are met. Eligibility requirements are available online at https://www.osfaffelp.org/bfiehs/fnbpcm02_CCTMain.aspx.

Fine Arts/Practical Arts Credit

Many courses in CTE programs meet the Fine Arts/Practical Arts credit for high school graduation. For additional information refer to http://www.fldoe.org/schools/pdf/ListPracticalArtsCourses.pdf.

The following table illustrates the **Secondary** program structure:

	Programming Focus Track	Length	Visual focus Track	Length
	Course Title		Course Title	
A	Modeling and Simulation Foundations	1 credit	Modeling and Simulation Foundations	1 credit
B	Modeling and Simulation Design	1 credit	Modeling and Simulation Design	1 credit
C	Modeling and Simulation Software Development	1 credit	Modeling and Simulation 2D/3D Visual Development	1 credit
D	Modeling and Simulation Software Research Project	1 credit	Modeling and Simulation Visual Research Project	1 credit

YEAR 1

Course Description:

This course is designed to provide an introduction to modeling and simulation concepts and careers, the impact modeling and simulation has on society and industry, and basic modeling and simulation design concepts such as rule design, play mechanics, and media integration. This course investigates modeling and simulation, mathematical and programming skills, and tools, careers, and industry-related information. This course also covers strategies, processes, and methods for conceptualizing modeling and simulation.

Instruction relating to the standards in this section should be interspersed throughout the entire course with the other standards taught progressively in the context of modeling and simulation design and development.

I. Modeling and Simulation Foundations

A. **Unit01**—Exploring Modeling and Simulation (M&S) (UNIT 1)

a. **Standard 1** (Unit 1:1) Know and Understand Modeling and Simulation Terminology: - The student will be able to:

1. 1.2 Define essential modeling and simulation terms and use in context
    a. 1.2.1 Define key areas for terminology

b. **Standard 2** (Unit 1:2) Understand the Disciplines Related to Modeling and Simulation. - The student will be able to:

1. 2.1 Identify disciplines which use modeling and simulation tools.
2. 2.2 Identify modeling and simulation related careers.
3. 2.3 Discuss educational requirements to enter the modeling and simulation career field.
4. 2.4 List and describe personal characteristics of modeling and simulation professionals.

c. **Standard 3** (Unit 1:3) Explore Modeling and Simulation Concept - The student will be able to:

1. 3.1 Define the major modeling and simulation concepts.
2. 3.2 Identify and analyze the differences between modeling and simulation concepts.
3. 3.3 Identify and analyze similarities among modeling and simulation concepts.
4. 3.4 Explain and expand upon the usage of different modeling and simulation concepts.

d. **Standard 4** (Unit 1:4) Demonstrate a knowledge of the History of Modeling and Simulation - The student will be able to:

1. 4.1 Explain the past, present, and future importance of modeling and simulation.
2. 4.3 Explain and use details to support the physical models by important historical models.
3. 4.2 Use graphic technology to create a Visualization of a historic simulator or synthetic environment.

e. **Standard 5** (Unit 1:5) Gain Familiarity with Emerging Research Techniques and Technology - The student will be able to:

1. Describe types of emerging technologies.
2. Identify Internet safety issues and procedures for complying with acceptable use standards.
3. Use technology tools to collaborate and generate a deliverable product.
4. Develop and present a digital presentation.
5. Develop and show/display an electronic portfolio.
6. Demonstrate research skills using browsers, search engines, directories, and databases.

7. Create and evaluate a list of materials found online for relevance, appropriateness and bias.
8. Present a multimedia presentation, including text, sound, and graphics, based on content from class work.

B. **Unit 2** – Demonstrating Basic Computer Skills
   a. **Standard** 2.1 Demonstrate knowledge, skill, and application of information systems to accomplish job objectives.
      1. Develop keyboarding skills to enter and manipulate text and data.
      2. Describe and use current and emerging computer technology and software to perform personal and business related tasks.
      3. Demonstrate basic file management skills.
   b. **Standard** 2.2 Demonstrate knowledge of different operating systems.
      1. Identify operating system file naming conventions.
      2. Demonstrate proficiency with file management and structure (e.g., folder creation, file creation, backup, copy, delete, open, save).
      3. Demonstrate a working knowledge of standard file formats.
      4. Explain the history and purpose of various operating systems (e.g., DOS, Windows, Mac, and Unix/Linux).
   c. **Standard** 2.3 Demonstrate proficiency navigating the Internet, intranet, and the WWW.
      1. Identify and describe Web terminology.
      2. Demonstrate proficiency in using the basic features of GUI browsers (e.g., setting bookmarks, basic configurations, e-mail configurations, address book).
      3. Define Universal Resource Locators (URLs) and associated protocols (e.g., .com, .org, .edu, .gov, .net, .mil).
      4. Describe and observe Internet/Intranet ethics and copyright laws and regulatory control.
      5. Trace the evolution of the Internet from its inception to the present and into the future.
      6. Demonstrate proficiency using search engines (e.g., Yahoo!, Google, Northern Light, Lycos, Excite, etc.).
      7. Demonstrate proficiency using various web tools (e.g., downloading of files, transfer of files, telnet, pdf, etc.).
      8. Identify effective Boolean search strategies
   d. **Standard** Demonstrate proficiency using HTML commands.
      1. Define basic HTML terminology.
      2. Analyze HTML source code developed by others.
      3. Create Web pages using basic HTML tags (e.g., links, lists, character styles, text alignment, and tables).
      4. Use storyboarding techniques for subsequent Web pages (e.g., linear, hierarchical).
      5. Edit and test HTML documents for accuracy and validity.
      6. Use basic functions of WYSIWYG editors.

7. Use basic functions of HTML, DHTML, and XML editors and converters.
8. Enhance web pages through the addition of images and graphics including animation.

e. **Standard** Manipulate file structures
   1. Create folder and subfolders
f. **Standard** Develop an awareness of the information technology industry.
   1. Explain how information technology impacts the operation and management of business and society.
   2. Explain the emergence of e-commerce and e-government and the potential impact on business and society.
   3. Explain the emergence of a paperless society.
g. **Standard** Develop an awareness of microprocessors and digital computers.
   1. Describe the evolution of the digital computer.
   2. Explain the general architecture of a microcomputer system.
   3. Explain the evolution of microprocessors.
   4. Explain software hierarchy and its impact on microprocessors.
   5. Explain the need for and use of peripherals.
   6. Demonstrate proficiency using peripherals.
   7. Identify the basic concepts of computer maintenance and upgrades.
   8. Differentiate between diagnosing and troubleshooting.
h. **Standard** Develop an awareness of programming languages.
   1. Explain the history of programming languages.
   2. Explain the need for and use of compilers.
   3. Explain how compilers work.
   4. Identify the three types of programming design approaches (e.g., top-down, structured and object-oriented).
i. **Standard** Develop an awareness of emerging technologies.
   1. Compare and contrast various methods of evaluation for emerging technologies.
   2. Demonstrate knowledge of the process of planning upgrades and changeovers.
   3. 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, etc.).
j. **Standard** Demonstrate proficiency using common software applications.
   1. Compare and contrast the appropriate use of various software applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music, etc.).
   2. Demonstrate proficiency in the use of various software applications (e.g., word processing, desktop publishing, graphics design, web browser, e-mail, presentation, database, scheduling, financial management, Java applet, music, etc.).

k. **Standard** Demonstrate proficiency in computer skills.
    1. Identify all computer parts (e.g., RAM, ROM).
    2. Demonstrate an understanding of all functions of a computer.
    3. Utilize appropriate font management techniques (e.g., TrueType, postscript, install and remove fonts).
    4. Perform storage management (e.g., hard drive, floppy disk).
    5. Perform maintenance of computers and peripherals.

l. **Standard** Identify hardware constraints on simulations including processors and I/O devices.
    1. Identify the different control systems for simulations.
    2. Explain the factors that can limit the simulation ability of personal computers.

m. **Standard** Identify computer components and their functions.
    1. Identify the internal components of a computer (e.g., power supply, hard drive, mother board, I/O cards/ports, cabling, etc.).
    2. Use common computer and programming terminology.

n. **Standard** Develop and apply spreadsheet skills. – The student will be able to:
    1. Create and navigate through a worksheet.
    2. Change column width and row height.
    3. Format the contents of a cell-change fonts and font sizes and align text, format numbers.
    4. Merge cells.
    5. Use Undo and Redo features.
    6. AutoFormat the worksheet if available. AutoFormat applies borders, shading, and data formatting.
    7. Use the auto sum feature.
    8. Create a bar chart, embedded, using the chart wizard.

C. **Unit02B—Investigating Modeling and Simulation**

a. **Standard** 1 (Unit 2B.1) (6.1) Become familiar with Basic Modeling and Simulation.) The student will be able to:
    1. Perform a hand (manual) simulation for a defined problem.
    2. Identify the various components of a simulation.
    3. Run simulation application given specific parameters.
    4. Explain verification and validation of a simulation.

b. **Standard** 2 (Unit 2B.2) (6.4) Explain distributed simulation. The student will be able to:
    1. Explain networking concepts.
    2. Explain distributed simulation protocols.
    3. Explain the major components in a networked simulation or game.

c. **Standard** 3 (Unit 2B.3) (6.5) Explain visual simulation. The student will be able to:
    1. Define visual simulation.
    2. Explain uses of visual simulation.
    3. Explain the use of visual simulation in distributed simulation.

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

d. **Standard** 4 (Unit 2B.5) (6.7) Explain intelligent systems. The student will be able to:
    1. Define intelligent system.
    2. Explain and examine structured logic and semantics.
    3. Explain the use of intelligent systems.
    4. Examine program using the elements of an intelligent system.
e. **Standard** 5 (Unit 2B.6) (6.8) Explain environmental models. The student will be able to:
    1. Explain the use of environmental modeling.
    2. Discuss how to model environmental effects.
    3. Discuss the effects of environmental simulations on related simulations.
    4. Examine some environmental models on the web.
f. **Standard** 6 (Unit 2B.7) (6.9) Build a simple scenario for experimentation or training. The student will be able to:
    1. Explain the importance of scenario building in simulations.
    2. Examine building blocks of scenarios.
    3. Design a storyboard for a simulation.
    4. Build a simple simulation with a limited number of variables.

D. **Unit03A—2D**
a. **Standard** Understand the various job titles and responsibilities of a 2D artist as it relates to the modeling and simulation industry. – The student will be able to:
    1. Explore the roles of 2D artists in a modeling and simulation project.
    2. Demonstrate the ability to work as part of an art team.
b. **Standard** Determine and document the graphical and animation needs of a modeling and simulation using design documents including art direction and reference materials. – The student will be able to:
    1. Understand the design requirements and limitations of a 2D modeling and simulation engine.
c. **Standard** Understand the fundamentals of drawing and painting techniques. – The student will be able to:
    1. Demonstrate the use (traditional or digital) of inks, watercolors, acrylics, oils, and mixed media in a 2D modeling and simulation.
d. **Standard** Demonstrate a working knowledge of vector and paint programs used to make 2D graphics and animation. – The student will be able to:
    1. Know the difference between Vectors and Bitmaps.
    2. Demonstrate understanding of various 2D art programs.
    3. Utilize the programs tools and brushes
    4. Know the importance of Layers.
    5. Identify file formats

e. **Standard** Understand the principles of Sprite animation as it relates to 2D modeling and simulation graphics (walk, run, Jump, idle…etc.). – The student will be able to:
    1. Demonstrate the ability to create character and object views from which to animate.
    2. Break down animation into a series of pictures to import animation to a modeling and simulation engine.
    3. Demonstrate the effective use of animation loops and cycles in a modeling and simulation engine.
    4. Demonstrate an understanding of the value of timing to convey character motion.
    5. Demonstrate the effective use of animation arcs for the articulation of body elements
    6. Demonstrate the use of principles of animation such as anticipation, squash, stretch, weight, exaggeration and overlapping & secondary motion.

This standard supports the following Next Generation Sunshine State Standards: MA.912.A.2.1, 2; MA.912.A.10.1, 2

E. **Standard 4** (Unit 4) Understanding Problem Analysis - The student will be able to:
    a. **Standard** 4.1 (Unit 4.1) Experimental Design The student will be able to:
        1. Use proper attributes to develop flowchart.
        2. Compare various types of studies (i.e. survey, observation, experiment).
        3. Identify and explain an experimental design process.
        4. Set realistic objectives of the experiment.
        5. Determine the appropriate the response or output.
        6. Select process variables or design parameters (control factors), noise factors and the interactions among the process variables of interest.
        7. Perform experimental design execution.
        8. Check that the data are consistent with the experimental assumptions
        9. Interpret the results.
        10. Present the results.
    b. **Standard** 4.2 (Unit 4.2) Discrete Event Simulation The student will be able to:
        1. Identify discrete event simulations.
        2. Use simulation as an analysis tool.
        3. Describe the output distribution.
        4. Use historical/empirical data.
        5. Correctly interprets summary statistics.
        6. Correctly interpret confidence and prediction (certainty) intervals.
        7. Identify sources and impact of error in simulations.

8. Describe relationships among variables.
9. Describe the effect of correlation on simulation results.

c. **Standard** 4.3 (Unit 4.3) Numerical Analysis Techniques The student will be able to:
   1. Apply logical reasoning skills to solve real-world problems through the development of mathematical models.
   2. Design a step-by-step plan (algorithm) to solve a given problem.
   3. Write program specifications that define the constraints of a given problem.
   4. Use a programmable calculator.
   5. Write an algorithm to solve mathematical problems using formulas, equations, and functions.

d. **Standard** 4.4 (Unit 4.4) Select Model Fidelity The student will be able to:
   1. Define fidelity.
   2. Discuss the ramifications of model fidelity parameters variations.
   3. Select the proper level of fidelity to solve a given problem.
   4. Identify the rationale for selecting fidelity level.
   5. Adjust model fidelity parameters to meet output requirements.

F. **Exhibiting Mathematical Skills (UNIT 5)**

a. **Standard** 1 (Unit 5.2) Describe the methods of data collection in a census, sample survey, experiment, and observational study and identify an appropriate method of solution for a given problem setting. The student will be able to:
   1. Define terminology associated with data collection.
   2. Differentiate between the various methods of data collection.
   3. Explain the uses of random number generators.
   4. Recognize various sources of bias in data collection.
   5. Prepare a sample data collection.

b. **Standard** 2 (Unit 5.2) Analyze graphical displays of data. The student will be able to:
   1. Define graphical terminology.
   2. Interpret tables of statistics.
   3. Create bar charts and pie graphs with appropriate software.
   4. Analyze the data to solve a presented problem.

c. **Standard** 3 (Unit 5.3) Analyze numerical characteristics of univariate data sets to describe patterns and departure from patterns, using mean, median, and mode for various distributions. The student will be able to:
   1. Define statistical terminology.
   2. Determine the numerical characteristics of a data set and analyze data.

d. **Standard** 4 (Unit 5.4) Identify and describe two or more events as complementary, dependent, independent, and/or mutually exclusive. The student will be able to:
   1. Define probability event terminology.
   2. Identify events as complementary, dependent, or independent.
   3. Identify events as mutually exclusive or not mutually exclusive.

e. **Standard** 5 (Unit 5.5) Find probabilities (relative frequency and theoretical), including conditional probabilities for events that are either dependent or independent, by applying the "law of large numbers" concept, the addition rule, and the multiplication rule. The student will be able to:
    1. Define probability terminology.
    2. Explain probability rules.
    3. Analyze categorical data using two-way tables to describe patterns and departure from patterns and to find marginal frequency and relative frequencies.
    4. Distinguish between empirical and theoretical probability.
    5. Calculate probabilities.
    6. Explain the law of large numbers.
    7. Calculate probabilities using addition rules.
    8. Calculate probabilities using the multiplications rules.

f. **Standard** 6 (Unit 5.6) Compute and distinguish between permutations and combinations and use technology for applications. The student will be able to:
    1. Define the *Fundamental Counting Rule, Permutation,* and *Combination.*
    2. Perform calculations using the Fundamental Counting Rule, Permutation and Combination.
    3. Distinguish when one would use a permutation and when one would use a combination.

g. **Standard** 7 (Unit 5.7) Plan and conduct an experiment that will address control, randomization, and measurement of experimental error. The student will be able to:
    1. Define experimental terminology.
    2. Explain potential reasons for experimental error.
    3. Conduct an experiment within the classroom.

h. **Standard** 8 (Unit5.8) Perform basic mathematical calculations as needed in software applications. The student will be able to:
    1. Define various probability distributions.
    2. Calculate the probability from a distribution.
    3. Perform discrete event simulations using probability distributions.
    4. Understand random number generation and its limitations.

G. **Demonstrating Programming (UNIT 6)**

a. **Standard** 1 (Unit 6.1) Examine computer programming factors that influence design. The student will be able to:
    1. Understand basic computer terminology.
    2. Explain how a basic computer works.
    3. Decompose problems.
    4. Apply problem analysis using flowcharts or the Unified Modeling Language (UML).
    5. Understand basic programming constructs.

6. Examine programming styles and design.

b. **Standard** 3 (Unit 6.3) Explain agent-based simulation. The student will be able to:
    1. Understand the concept of a distributed environment.
    2. Explain the architecture of agent based simulation.
    3. Describe the uses of agent based modeling.
    4. Define software lifecycle
    5. Identify the lifecycle model.
    6. Describe the steps in the lifecycle model.
    7. Describe advantages and disadvantages of each type of model.
    8. Understand project management principals.

c. **Standard** 4 (Unit 6.4) Explore software evolution and lifecycle. The student will be able to:
    1. Define software lifecycle
    2. Identify the lifecycle model.
    3. Describe the steps in the lifecycle model.
    4. Describe advantages and disadvantages of each type of model.
    5. Understand project management principals.
    6. Understand extreme programming.

d. **Standard** 5 (Unit 6.5) Apply simple gaming concepts. The student will be able to:
    1. Describe the history of gaming and evolution of video games.
    2. Design games using programming techniques.
    3. Implement a simple game using appropriate software.

H. Unit 11: Dealing With Ethical Issues

i. **Standard Analyze ethical issues. The student will be able to:**
    1. Apply ethical and legal issues (including copyright) with technology.
    2. Develop understanding of professional and ethical responsibilities.
    3. Describe and behave in an ethical manner.
    4. Use accepted Netiquette
    5. Describe polite and civil communication.
    6. Discuss individual integrity and honesty.
    7. Explain the purposes of copyrights, trademarks, and patents.
    8. Practice ethical behaviors regarding copyright, citation, and plagiarism.

YEAR 2

Course Description:

This course covers fundamental principles of modeling and simulation application and design, in particular animation and modeling principles, 3-D software, problem analysis and demonstrating program and software applications.

II. Modeling and Simulation Design

a. **Investigating Modeling and Simulation (UNIT 2B)**

i. **Standard** 1 (Unit 2B.1) (6.1) Review and implementation of Modeling and Simulation concepts and principles. The student will be able to:
   1. Perform a hand (manual) simulation for a defined problem.
   2. Identify the various components of a simulation.
   3. Design, implement, and execute simulation applications given specific parameters.

ii. **Standard** 2 (Unit 2B.2) (6.4) Review/Implement a simple distributed simulation. The student will be able to:
   1. Review/Implement networking concepts.
   2. Review/Implement distributed simulation protocols.
   3. Review/Implement the major components in a networked simulation or game.

iii. **Standard** 3 (Unit 2B.3) (6.5) Review/explore visual simulation. The student will be able to:
   1. Define visual simulation.
   2. Review/explore uses of visual simulation free commercially available simulators such as Google Earth Flight Simulator or Microsoft Flight Simulator.
   3. Review/explore the use of visual simulation in distributed simulation.
   4. Review/explore the functions of the image generators, display and databases to support visual subsystem of simulators.

iv. **Standard** 4 (Unit 2B.5) (6.7) Explore intelligent systems. The student will be able to:
   1. Review intelligent system.
   2. Review/explore structured logic and semantics.
   3. Explore the use of intelligent systems.
   4. Examine program using the elements of an intelligent system.

v. **Standard** 5 (Unit 2B.6) (6.8) Explore environmental models. The student will be able to:
    1. Explore the use of environmental modeling.
    2. Use commercially free available simulators such as Google Earth Flight Simulator or Microsoft Flight Simulator to model environmental effects.
    3. Demonstrate the effects of environmental simulations on related simulations.
    4. Explore some environmental models on the web.

vi. **Standard** 6 (Unit 2B.7) (6.9) Build a scenario for experimentation or training. The student will be able to:
    1. Review the importance of scenario building in simulations.
    2. Explore/develop building blocks of scenarios.
    3. Design a detailed storyboard for a simulation.
    4. Build a simulation with a level of fidelity.

b. Unit03B—3D
    i. **Standard** Review the history of Animation--The student will be able to:
        1. Review the history of animation.
        2. Identify the advantages and limitations of computer animation.
    ii. **Standard** Understand the production process–The student will be able to:
        1. Identify the job titles associated with animation production.
        2. Identify various tools and equipment used to produce 3D animation.
        3. Understand speed and efficiency concepts
        4. Understand a production pipeline.
        5. Identify the departments of an animation studio.
        6. Understand the interrelationships between departments.
        7. Understand basic communication concepts (verbal, memos, paperwork).
        8. Identify the stages of production.
        9. Understand studio terms and jargon.
        10. Create and organize production paperwork into design/production documentation.
    iii. **Standard** Understand intellectual property rights, copyright laws and plagiarism as it applies to creative assets–The student will be able to:
        1. Understand the limits and expectations of copyright protection.
        2. Understand the use of “Fair use and Fair Dealing”.
        3. Understand the transfer and licensing of creative works.
        4. Understand the use of “exclusive rights” to intellectual creations.
        5. Demonstrate the use of digital watermarking.
    iv. **Standard** Demonstrate knowledge of photo editing software--The student will be able to:
        1. Demonstrate understanding file formats and storage options.
        2. Identify parts of the software interface. (menus/palettes)
        3. Demonstrate ability to use each of the basic tool sets.

4. Demonstrate ability to import, export and save images.
5. Demonstrate understanding of layers and channels.
6. Demonstrate understanding of filters, effects and plug-ins.
7. Demonstrate understanding of file presets.
8. Demonstrate ability to select portions of an image for manipulation.
9. Demonstrate ability to transforms selections and images. (crop, scale)
10. Demonstrate ability to color correct images (brightness, hue, contrast)
11. Demonstrate ability to use brushes for image creation and correction.
12. Understand non-destructive and destructive operations.
13. Demonstrate the ability to import, paint and export 3D objects

II. This standard supports the following Next Generation Sunshine State Standards: MA.912.A.1.5; MA.912. A.2.1, 2; MA.912.G.2.7; MA.912.G.5.4; MA.912.G.6.2, 4, 5

i. **Standard** Demonstrate a knowledge of production writing as it relates to 3D animation. The student will be able to:
   1. Identify target audiences, markets, and demographics.
   2. Demonstrate ability to write a professionally formatted script.
   3. Demonstrate ability to breakdown a script into production elements (cast, props).

ii. **Standard** Demonstrate knowledge of storyboarding--The student will be able to:
   1. Demonstrate understanding of visual storytelling and how storyboards are used during production.

This standard supports the following Next Generation Sunshine State Standards: MA.912.A.5.1, 4

iii. **Standard** Demonstrate knowledge of video editing software--The student will be able to:
   1. Demonstrate understanding file formats and storage options.
   2. Identify parts of the software interface. (menus/palettes)
   3. Demonstrate ability to use each of the basic tool sets.
   4. Demonstrate ability to import, export and save video.
   5. Demonstrate understanding of layers and compositing.
   6. Demonstrate understanding of filters, effects and plug-ins.
   7. Demonstrate understanding of file presets.
   8. Demonstrate understanding of rendering process.
   9. Demonstrate ability to transform video (crop, scale).
   10. Demonstrate ability to color correct images (brightness, hue, contrast)
   11. Demonstrate ability to use brushes for image creation and correction.
   12. Understand non-destructive and destructive operations.

13. Demonstrate the compositing integration of rendered 3D animation with video.

iv. **Standard** Understand modeling in relation to the production process. The student will be able to:
    1. Define modeling as a process.
    2. Define the role of modeler.
    3. Identify job titles associated with modeler.
    4. Identify modeling in the production pipeline.

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.1

v. **Standard** Demonstrate knowledge of animation principles as it relates to modeling--The student will be able to:
    1. Demonstrate an understanding of the principle - squash and stretch.
    2. Demonstrate an understanding of the principle - anticipation.
    3. Demonstrate an understanding of the principle - staging.
    4. Demonstrate an understanding of the principle - straight ahead action and pose to pose.
    5. Demonstrate an understanding of the principle - follow through and overlapping action.
    6. Demonstrate an understanding of the principle - slow in and slow out.
    7. Demonstrate an understanding of the principle - arcs.
    8. Demonstrate an understanding of the principle - secondary action.
    9. Demonstrate an understanding of the principle - timing.
    10. Demonstrate an understanding of the principle - exaggeration.
    11. Demonstrate an understanding of the principle - solid drawing.
    12. Demonstrate an understanding of the principle - appeal.

This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.1

vi. **Standard** Demonstrate knowledge of modeling principles--The student will be able to:
    1. Understand 3D construction theory.
    2. Demonstrate understanding of primitives, parametric modeling.
    3. Demonstrate an understanding of NURBS, splines, and polygonal modeling.
    4. Demonstrate ability to use reference images and files while modeling.

This standard supports the following Next Generation Sunshine State Standards: MA.912.G.7.1, 2, 3, 4, 5, 6, 7; MA.912.G.8.6

vii. **Standard** Demonstrate knowledge of 3D Animation Software--The student will be able to:

1. Identify the computer requirements for 3D animation software.
2. Compare and contrast available 3D animation software.
3. Identify available file formats and protocols.
4. Demonstrate an understanding of naming conventions.
5. Develop software and file backup plan.
6. Identify common icons within the software.
7. Demonstrate use of keyboard shortcuts.
8. Understand the use of a three-button mouse.

viii. **Standard** Demonstrate knowledge of 3D Animation software navigation--The student will be able to:

1. Identify the main windows of a 3D program.
2. Identify common window layouts.
3. Identify tool icons within the software.
4. Understand the significance of keyboard shortcut use and efficiency.
5. Demonstrate use of keyboard shortcuts.
6. Demonstrate an understanding of the Euclidean Geometry Model (x-y-z- coordinate system).
7. Demonstrate an understanding of attribute managers.
8. Demonstrate an understanding of layers.
9. Navigate the modeling window using pan, rotate, and zoom controls.
10. Demonstrate knowledge of selection tools (lasso, loop).
11. View objects in wireframe, gourard shading, lines, boxes modes.
12. Demonstrate use of selection sets.
13. Undo and redo an action within the program.
14. Locate the help menu system.

ix. **Standard** Demonstrate knowledge of NURBS modeling--The student will be able to:

1. Demonstrate an understanding of points, vertices, edges, and polygons.
2. Demonstrate an understanding of poly-count.
3. Demonstrate an understanding of primitives.
4. Define parametric primitives.
5. Locate an object's properties, attributes, and coordinates.
6. Demonstrate understanding of Non uniform rational b-splines (NURBS).
7. Demonstrate understanding of splines and generators (extrude, lathe, sweep).
8. Understand the use of hierarchy.
9. Demonstrate an understanding of Boolean objects.
10. Demonstrate an understanding of Null objects.
11. Demonstrate an understanding of scene management (hiding-unhiding).
12. Demonstrate an understanding of arrays.

This standard supports the following Next Generation Sunshine State Standards: MA.912.D.10.1, 2, 3; MA.912.G.1.2, 3, 4; MA.912.G.2.1, 2, 3

x. **Standard** Demonstrate knowledge of polygon modeling--The student will be able to:
    1. Demonstrate an understanding of N-gons.
    2. Demonstrate an understanding of subdivision.
    3. Demonstrate basic polygon editing and manipulation.
    4. Demonstrate knowledge of point management (location).
    5. Demonstrate the ability to create polygonal models from points.
    6. Demonstrate an understanding of cutting/division tools.
    7. Demonstrate an understanding of extrudes.
    8. Demonstrate an understanding of symmetry.
    9. Demonstrate an understanding of hyper NURBS.
    10. Demonstrate an understanding of basic deformers (bend, twist, melt).

This standard supports the following Next Generation Sunshine State Standards: MA.912.G.2.6; MA.912.G.3.3; MA.912.G.4.5, 6; MA.912.G.5.1, 4

xi. **Standard** Demonstrate knowledge of basic lighting--The student will be able to:
    1. Compare and contrast real lighting with 3D lighting.
    2. Demonstrate an understanding 3 point lighting (key, fill, back).
    3. Demonstrate an understanding of low key and high key lighting.
    4. Uses include/exclude commands to target light on objects.
    5. Demonstrate use of negative intensity.

xii. **Standard** Demonstrate knowledge of basic materials and textures--The student will be able to:
    1. Demonstrate an understanding of material and texture storage.
    2. Apply textures to an object.
    3. Demonstrate an understanding of procedural shaders.
    4. Demonstrate an understanding of channels.
    5. Adjust the transparency, luminance, and reflection of a material.
    6. Demonstrate an understanding of displacement maps.
    7. Demonstrate an understanding of bump maps.
    8. Demonstrate knowledge of material projections.
    9. Demonstrate an understanding of UV mapping.
    10. Demonstrate an understanding of 3D painting.
    11. Understand how light affects the look of materials.
    12. Understand how camera angles can affect the look of materials.

This standard supports the following Next Generation Sunshine State Standards: MA.912.G.7.5, 6, 7

xiii. **Standard** Demonstrate knowledge of basic animation--The student will be able to:
    1. Apply animation principles to object animation.
    2. Demonstrate an understanding of animation timelines.
    3. Demonstrate an understanding of key framing.
    4. Record and edit key frames.
    5. Demonstrate an understanding in the use of controllers.
    6. Render low quality reference animation.

This standard supports the following Next Generation Sunshine State Standards: MA.912.D.9.1, 2, 3; MA.912.S.3.1, 2

xiv. **Standard** Demonstrate knowledge of basic character setup--The student will be able to:
    1. Compare and contrast rigging approaches and styles.
    2. Demonstrate an understanding of the rig as it relates to the model.
    3. Demonstrate an understanding of skeletal systems.

xv. **Standard** Demonstrate knowledge of basic 3D rendering–The student will be able to:
    1. Demonstrate an understanding of processor, hardware and software rendering techniques.
    2. Determine the final render format (size, codec, quality).
    3. Demonstrate an understanding of basic render settings.
    4. Select the range of frames to be rendered.

xvi. **Standard** Understand the role of texture artist in relation to the production process--The student will be able to:
    1. Define texturing as a process.
    2. Define the role of texture artist.
    3. Identify job titles associated with texture artist.
    4. Identify texture creation in the production pipeline.
    5. Demonstrate knowledge of the difference between textures and shaders.

xvii. **Standard** Demonstrate knowledge of rigging–The student will be able to:
    1. Define rigging as a process.
    2. Define the role of rigger.
    3. Identify job titles associated with a rigger.
    4. Identify rigging creation in the production pipeline.

xviii. **Standard** Understand knowledge of motion capture systems--The student will be able to:
    1. Understand knowledge of the history of motion capture.
    2. Understand the awareness of emerging technologies in the industry.
    3. Understand motion capture for 3D production.

This standard supports the following Next Generation Sunshine State Standards: MA.912.A.1.6, 7; MA.912.A.9.1, 2, 3; MA.912.T.4.1, 2, 3, 4

b. **Standard 4** (Unit 4) Understanding Problem Analysis - The student will be able to:
    i. Instruction relating to the standards in this section should be interspaced throughout the entire course with other standards taught progressively in the course of modeling and simulation.
        1. Define the experimental design process.
        2. Explain discrete event simulation.
        3. Apply numerical analysis techniques.
        4. Select appropriate level of fidelity for a model
    ii. **Standard** 4.1 (Unit 4.1) Experimental Design The student will be able to:
        1. Use proper attributes to develop flowchart.
        2. Compare various types of studies (i.e. survey, observation, experiment).
        3. Identify and explain an experimental design process.
        4. Set realistic objectives of the experiment.
        5. Determine the appropriate response or output.
        6. Select process variables or design parameters (control factors), noise factors and the interactions among the process variables of interest.
        7. Perform experimental design execution.
        8. Check that the data are consistent with the experimental assumptions
        9. Interpret the results.
        10. Present the results.
    iii. **Standard** 4.2 (Unit 4.2) Discrete Event Simulation The student will be able to:
        1. Identify discrete event simulations.
        2. Use simulation as an analysis tool.
        3. Describe the output distribution.
        4. Use historical/empirical data.
        5. Correctly interpret summary statistics.
        6. Correctly interpret confidence and prediction (certainty) intervals.
        7. Identify sources and impact of error in simulations.
        8. Describe relationships among variables.
        9. Describe the effect of correlation on simulation results.
    iv. **Standard** 4.3 (Unit 4.3) Numerical Analysis Techniques The student will be able to:
        1. Apply logical reasoning skills to solve real-world problems through the development of mathematical models.
        2. Design a step-by-step plan (algorithm) to solve a given problem.

3. Write program specifications that define the constraints of a given problem.
4. Use a programmable calculator.
5. Write an algorithm to solve mathematical problems using formulas, equations, and functions.

v. **Standard** 4.4 (Unit 4.4) Select Model Fidelity The student will be able to:
1. Define fidelity.
2. Discuss the ramifications of model fidelity parameters variations.
3. Select the proper level of fidelity to solve a given problem.
4. Identify the rationale for selecting fidelity level.
5. Adjust model fidelity parameters to meet output requirements

c. Demonstrating Programming (UNIT 6)

i. Standard 1 (Unit 6.1) Explore computer programming factors that influence design. The student will be able to:
1. Decompose problems.
2. Apply problem analysis using flowcharts or the Unified Modeling Language (UML).
3. Understand programming constructs.
4. Explore programming styles and design.

ii. Standard 2 (Unit 6.2) Explain object models. The student will be able to:
1. Describe objects using object oriented design (OOD).
2. Distinguish between abstract and real objects.
3. Explain why object oriented design is an effective programming paradigm.
4. Implement classes and methods.
5. Describe the benefits of object oriented concepts.
6. Describe OOD using pseudo-code or UML.

iii. Standard 3 (Unit 6.3) Explore agent-based simulation. The student will be able to:
1. Demonstrate the concept of a distributed environment.
2. Explore the architecture of agent based simulation.
3. Demonstrate the uses of agent based modeling.

iv. Standard 4 (Unit 6.4) Explore software evolution and lifecycle. The student will be able to:
1. Review software lifecycle models.
2. Explain the steps in the lifecycle model.
3. Explain advantages and disadvantages of each type of model.
4. Demonstrate project management principals.

v. Standard 5 (Unit 6.5) Apply gaming concepts. The student will be able to:
1. Review the history of gaming and evolution of video games.
2. Review the concept of interrupts and how they are handled.
3. Design games using programming techniques.
4. Implement a game using appropriate software.

d. Unit 9.0

i. Unit 9.1

1. Understand the process groups and knowledge areas that comprise the Project Management Body of Knowledge.

e. Audio

i. Understand the methodologies for integrating digital media into a game or simulation. – The student will be able to:

ii. Survey and discuss the use of naming conventions and temp sounds.
iii. Analyze and discuss methods of matching sound effects to art assets.
iv. Identify and categorize commonly used technology sound engine integration equipment.
v. Identify and discuss resources such as sound effects libraries.
vi. Examine methods of sound implementation and associated software.
vii. Describe how and why digital video may be integrated into a game or simulation design.
viii. Describe how special effects differ from animation.

YEAR 3

****Programming—Software****

Course Description:

This course is focused on students acquiring the appropriate programming skills for rendering a modeling and simulation programming, including virtual simulators, Project Management body of knowledge, the principles and methodology of logistics in engineering management, and software design.

III. Modeling and Simulation Software Development

A. **UNIT 7.0: REAL TIME VIRTUAL SIMULATORS**

a. **Standard** 7.1 (Unit 7.1) Theory and Major Components

1. Understand concepts of the transfer of training
2. Understand mathematics of Physics' Based Real-time Simulators.
3. Describe components of visual systems (image generation, data bases and displays)
4. Describe theory of motion/ control loading simulation and cue synchronization.
5. Describe trainee station design, sensor simulation and instructor/operator station design

f. **Standard** 7.2 (Unit 7.2) Applications of Real Time Simulators

1. Identify simulator applications
2. Identify where team simulators would be appropriate
3. Identify where individual simulators would be appropriate
4. Understand where and why networked simulators are used

g. **Standard** 7.3 (Unit 7.3) Systems Engineering the Simulator

1. Understand the Systems Engineering life cycle process and terminology.
2. Identify the major milestones in the system life cycle.
3. 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.

4. 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).

B. Standard 8.0

a. (Unit 8.1) Teaching students the methods necessary to take a product/invention to the marketplace.
    1. Identify the use for technology application
    2. Determine the design architecture
    3. Formulate and test a proof of concept

b. Unit 8.2: Protecting Intellectual Property
    1. Understand the process of patent application filing, product trials, and communication techniques to describe their product.
    2. Explore and examine the Intellectual Property Methods such as patents, copyrights, trademarks, and trade secrets.

c. Unit 8.3: Develop a comprehensive business plan that will expose students to the practical steps of developing a commercial business model
    1. Develop a comprehensive business model
    2. Examine team building skills
    3. Understand the value of partnerships and sub-contracting of production and distribution of product.
    4. Develop an understanding of the production process
    5. Understand return on investment (ROI) concepts
    6. Examine market analysis of product
    7. Develop and present a successful proposal for investors

C. Unit 9.0

a. Unit 9.1
    1. Review the process groups and knowledge areas that comprise the Project Management body of knowledge.
    2. Use appropriate PMBOK terminology
    3. Define a Project.
    4. Define Project Management.
    5. Define the role of a Project Manager.
    6. Define the role(s) of Project Stakeholders.
    7. Discuss the Project life cycle.
    8. Define Project Scope

b. Unit 9.2: Students will demonstrate an understanding of Scope Management and constructing a project schedule
    1. Detail the scope of the modeling and simulation project.
    2. Detail the work to be done by creating a Work Breakdown Structure (WBS).
    3. Develop a project schedule by:
        a. Properly sequencing the work to be done (as noted in the WBS).

b. Make estimates of the required work durations.
c. Assign resources to the work to be done.

c. Unit 9.3: Students will demonstrate an understanding of the processes involved in Cost Management and demonstrate an understanding of the risk management.
    1. Create a Performance Measurement Baseline (PMB) for the Project.
    2. Create a performance report that displays performance to plan for cost and schedule.
    3. Develop an outline for a risk management plan for the M&S project.
    4. Brain-storm potential project risks.
    5. Identify risk mitigation measures.

D. Unit 10: Logistics Engineering and Management

a. Unit 10.1: Understand the principles and methodology of incorporating logistics features in the design of systems.
    1. Understand how to perform predictions for system Mean-Time-Between-Failures (MTBF)
    2. Understand how to perform predictions for Mean-Time-To-Repair (MTTR)
    3. Understand how to perform predictions for Inherent Availability (Ai)
    4. Understand how to perform predictions for Operational Availability (Ao)
    5. Describe a systems block diagram showing allocated values for MTBF and MTTR
    6. Understand qualitative maintainability design features
    7. Understand how MTBF and MTTR are tested, validated and verified.

b. Unit 10.2: Integrated Logistic Support: Understand the concepts of Integrated Logistics Support (ILS) and life cycle support planning and costs.
    1. Define Integrated Logistic Support and identify the elements of support
    2. Understand how the elements of support affect system utilization and availability
    3. Understand the process of logistic support analysis
    4. Understand the role of the Logistic Support Manager
    5. Understand Integrated Project Teams
    6. Understand Logistic Support Plans
    7. Understand the life cycle costing process
    8. Understand the concept of logistic support validation and verification

E. "NEW" UNIT 11—Software Design

a. Identify functions of information processing. – The student will be able to:

a. Identify characteristics of high-level languages.
b. Identify characteristics of operating systems.
c. Identify causes of software development problems in the game/simulation industry.
d. Identify how numeric and non-numeric data are represented in memory.
e. Distinguish among integer, fixed-point, and floating-point calculations.

b. Test programs. – The student will be able to:
a. Perform debugging activities.
b. Evaluate program test results.
c. Use trace routines of compilers to assist in program debugging.
d. Compile and run programs.
e. Create a stable code base.
f. Develop data for use in program testing.
g. Distinguish among the different types of program and design errors.

c. Plan program design. – The student will be able to:
a. Formulate a plan to determine program specifications individually or in groups.
b. Use a graphical representation or pseudo code to represent the structure in a program or subroutine.
c. Design programs to solve problems using problem-solving strategies.

d. Code programs. – The student will be able to:
a. Utilize reference manuals.
b. Write programs according to recognized programming standards.
c. Write internal documentation statements as needed in the program source code.
d. Code programs in high-level languages for game/simulation applications.
e. Write code that accesses sequential, random, and direct files.
f. Code programs using logical statements (e.g., If-Then-Else, Do...While).
g. Enter and modify source code using a program language editor.
h. Code routines within programs that validate input data.
i. Use the rounding function in calculations within programs.
j. Write programs as part of a development team.
k. Write event-driven programs.
l. Write programs using timed-event strategies and methodologies.
m. Write programs that include score keeping.
n. Write programs that display text
o. Write programs that use composite graphic objects
p. Write programs that load a bitmap for background
q. Write programs that use a sprite handler
r. Write programs that use animation

s. Write programs that use scrolling
t. Write programs that use transparency

e. Perform program maintenance. – The student will be able to:
- **a.** Review requested modification of programs and establish a plan of action.
- **b.** Design needed modifications in conformance with established standards.
- **c.** Code, test, and debug modifications prior to updating production code.
- **d.** Update production programs and documentation with changes.
- **e.** Analyze output to identify and annotate errors or enhancements.

f. Create and maintain documentation. – The student will be able to:
- **a.** Write documentation to assist operators and end-users.
- **b.** Follow established documentation standards.
- **c.** Update existing documentation to reflect program changes.

g. Implement enhanced program structures. – The student will be able to:
- **a.** Write programs that include tables or arrays and routines for data entry and lookup.
- **b.** Write programs to import/export data from external sources.
- **c.** Write programs that use iteration.
- **d.** Write routines that incorporate "help" text.
- **e.** Write programs that read and write random files.
- **f.** Write interactive programs.
- **g.** Design screen layouts for use in interactive programs.
- **h.** Write programs using object-oriented languages.
- **i.** Write programs that include data structures (e.g., stacks, queues, trees, linked lists).
- **j.** Write programs that are event-driven to support player goals and actions.

h. Implement enhanced program structures. – The student will be able to:
- **a.** Write programs that include tables or arrays and routines for data entry and lookup.
- **b.** Write programs to process transactions.
- **c.** Write programs that read and write sequential files.
- **d.** Write programs that read and write random files.

i. Implement multimedia programming. – The student will be able to:
- **a.** Demonstrate proficiency in creating multiple composite objects.
- **b.** Demonstrate proficiency in moving composite graphics objects.
- **c.** Demonstrate proficiency in rotating composite graphics objects by hand.
- **d.** Distinguish between flock and flee artificial intelligence algorithms.
- **e.** Write programs that use blitting.
- **f.** Identify the basic constructs used in bounding box collision algorithm.
- **g.** Identify the basic constructs used in truer bounding box collision.
- **h.** Demonstrate proficiency in creating a creating a bouncing simulation.
- **i.** Simulate pattern based movement.
- **j.** Simulate multiple sprites movement.

k. Identify the basic constructs used in keyboard input.
l. Identify the basic constructs used in mouse input.
m. Identify the basic constructs used in double buffering.

Develop an understanding of programming techniques and concepts. – The student will be able to:

n. Identify the basic constructs used in structured programming.
o. Distinguish between top-down and bottom-up design.
p. Distinguish between iteration and recursion.
q. Evaluate Boolean expressions.
r. Distinguish between interpreters and compilers.

F. Audio

a. Perform various job roles typical for an audio technician on a game/ simulation project. – The student will be able to:
  a. Identify the job titles of audio technicians and artists typically involved in a game project.
  b. Work as part of a sound design team.

b. Demonstrate basic audio production. – The student will be able to:
  a. Describe digital audio storage concepts and digital storage media.
  b. Operate digital recording decks and other digital storage devices.
  c. Describe the function and operation of digital audio workstations.
  d. Edit, cut, erase, and insert sound utilizing various digital production techniques.
  e. Perform digital noise reduction and noise extraction via spectral display.

c. Incorporate audio assets into game/simulation engine. – The student will be able to:
  a. Describe the audio effects workflow.
  b. Explain audio codecs and formats used in game/simulation engines.
  c. Import audio into the game/simulation engine
  d. Use appropriate naming conventions for audio assets.
  e. Describe the use of 3D and surround sound.
  f. Apply knowledge of distance/spatial effects including surround sound in a game/simulation.
  g. Contrast the audio environment as it relates to the visual environment

YEAR 4
****Programming—Software****

Modeling and Simulation Advanced Applications – Capstone Project - Software

A. Implement enhanced program structures. – The student will be able to:
   a. Write programs that include tables or arrays and routines for data entry and lookup.
   b. Write programs to import/export data from external sources.
   c. Write programs that use iteration.
   d. Write routines that incorporate "help" text.
   e. Write programs that read and write random files.
   f. Write interactive programs.
   g. Design screen layouts for use in interactive programs.
   h. Write programs using object-oriented languages.
   i. Write programs that include data structures (e.g., stacks, queues, trees, linked lists).
   j. Write programs that are event-driven to support player goals and actions.

LACC.1112.RST.1.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

LACC.910.RST.1.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LACC.910.RST.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.

LACC.1112.WHST.1.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LACC.1112.RST.2.4: 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.

LACC.910.RST.2.5: Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., 2D, 3D, visual models, software programs).

LACC.1112.RST.3.7: 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.

LACC.910.RST.3.7: 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.

LACC.1112.WHST.3.9: Draw evidence from informational texts to support analysis, reflection, and research.

LACC.1112.RST.4.10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.

MACC.912.N-Q.1.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

MACC.912.N-Q.1.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

MACC.912.S-IC.2.3: Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

MACC.912.S-IC.2.6: Evaluate reports based on data.

MACC.912.F-IF.3.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

YEAR 3
****VISUAL****

This course is focused on students acquiring the appropriate programming skills for rendering a modeling and simulation programming, including virtual simulators, Project Management body of knowledge, the principles and methodology of logistics in engineering management, and visual design.

V. Modeling and Simulation 2D/3D Visual Development

A. **UNIT 7.0: REAL TIME VIRTUAL SIMULATORS**

a. **Standard** 7.1 (Unit 7.1) Theory and Major Components

i. Understand concepts of the transfer of training
ii. Understand mathematics of Physics' Based Real-time Simulators.
iii. Describe components of visual systems (image generation, data bases and displays)
iv. Describe theory of motion/ control loading simulation and cue synchronization.
v. Describe trainee station design, sensor simulation and instructor/operator station design

b. **Standard** 7.2 (Unit 7.2) Applications of Real Time Simulators

i. Identify simulator applications
ii. Identify where team simulators would be appropriate
iii. Identify where individual simulators would be appropriate
iv. Understand where and why networked simulators are used

c. **Standard** 7.3 (Unit 7.3) Systems Engineering the Simulator

i. Understand the Systems Engineering life cycle process and terminology.
ii. Identify the major milestones in the system life cycle.
iii. 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.

iv. 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).

g. **Standard 8.0**
   - **a.** (Unit 8.1) Teaching students the methods necessary to take a product/invention to the marketplace.
     - **i.** Identify the use for technology application
     - **ii.** Determine the design architecture
     - **iii.** Formulate and test a proof of concept
   - **b.** Unit 8.2: Protecting Intellectual Property
     - **i.** Understand the process of patent application filing, product trials, and communication techniques to describe their product.
     - **ii.** Explore and examine the Intellectual Property Methods such as patents, copyrights, trademarks, and trade secrets.
   - c. Unit 8.3: Develop a comprehensive business plan that will expose students to the practical steps of developing a commercial business model
     - i. Develop a comprehensive business model
     - ii. Examine team building skills
     - iii. Understand the value of partnerships and sub-contracting of production and distribution of product.
     - iv. Develop an understanding of the production process
     - v. Understand return on investment (ROI) concepts
     - vi. Examine market analysis of product
     - vii. Develop and present a successful
     - viii. proposal for investors

h. **Unit 9.0**
   - **a.** Unit 9.1
     - **i.** Review the process groups and knowledge areas that comprise the Project Management body of knowledge.
     - **ii.** Use appropriate PMBOK terminology.
     - **iii.** Define a Project.
     - **iv.** Define Project Management.
     - **v.** Define the role of a Project Manager.
     - **vi.** Define the role(s) of Project Stakeholders.
     - **vii.** Discuss the Project life cycle.
     - **viii.** Define Project Scope

   - **b.** Unit 9.2: Students will demonstrate an understanding of Scope Management and constructing a project schedule
     - **i.** Detail the scope of the modeling and simulation project.
     - **ii.** Detail the work to be done by creating a Work Breakdown Structure (WBS).
     - **iii.** Develop a project schedule by:
       1. **1.** Properly sequencing the work to be done (as noted in the WBS).
       2. **2.** Make estimates of the required work durations.

3. Assign resources to the work to be done.

c. Unit 9.3: Students will demonstrate an understanding of the processes involved in Cost Management and demonstrate an understanding of the risk management.
    i. Create a Performance Measurement Baseline (PMB) for the Project.
    ii. Create a performance report that displays performance to plan for cost and schedule.
    iii. Develop an outline for a risk management plan for the M&S project.
    iv. Brain-storm potential project risks.
    v. Identify risk mitigation measures.

i. **Unit 10: Logistics Engineering and Management**
    a. Unit 10.1: Understand the principles and methodology of incorporating logistics features in the design of systems.
        i. Understand how to perform predictions for system Mean-Time-Between-Failures (MTBF)
        ii. Understand how to perform predictions for Mean-Time-To-Repair (MTTR)
        iii. Understand how to perform predictions for Inherent Availability (Ai)
        iv. Understand how to perform predictions for Operational Availability (Ao)
        v. Describe a systems block diagram showing allocated values for MTBF and MTTR
        vi. Understand qualitative maintainability design features
        vii. Understand how MTBF and MTTR are tested, validated and verified.

j. **Unit 10.2: Integrated Logistic Support:** Understand the concepts of Integrated Logistics Support (ILS) and life cycle support planning and costs.
    a. Define Integrated Logistic Support and identify the elements of support
    b. Understand how the elements of support affect system utilization and availability
    c. Understand the process of logistic support analysis
    d. Understand the role of the Logistic Support Manager
    e. Understand Integrated Project Teams
    f. Understand Logistic Support Plans
    g. Understand the life cycle costing process
    h. Understand the concept of logistic support validation and verification

k. Unit03B—3D
    a. Standard Demonstrate basic 3D rendering–The student will be able to:
        i. Review processor, hardware and software rendering techniques.
        ii. Review the final render format (size, codec, quality).
        iii. Review basic render settings.
        iv. Demonstrate an understanding of title safe, action safe, render safe.
        v. Review how to select the range of frames to be rendered.

vi. Demonstrate an understanding of global illumination (radiosity) render settings.
vii. Demonstrate an understanding of anti-aliasing.
viii. Demonstrate an understanding of net rendering.
ix. Demonstrate an understanding of alpha channels.
x. Render animation as a movie or image sequence.
xi. Compile image sequence into a movie.
xii. Demonstrate an understanding of benefits, purpose and workflow of multi-pass rendering.
xiii. Demonstrate an understanding of the batch render process.

l. **Standard** Explore the role of texture artist in relation to the production process--The student will be able to:
    a. Review texturing as a process.
    b. Review the role of texture artist.
    c. Review job titles associated with texture artist.
    d. Review texture creation in the production pipeline.
    e. Review the difference between textures and shaders.
    f. Demonstrate an understanding of texture projection methods.
    g. Demonstrate an understanding on UV coordinates and their application to texture mapping.
    h. Demonstrate an understanding of the round-trip integration of Photoshop and a 3D host for texture development.
    i. Demonstrate an understanding of how to link texture and shader properties to object movement via either visual or scripted programming relationships.
m. **Standard** Demonstrate knowledge color theory--The student will be able to:
    a. Demonstrate an understanding of additive and subtractive color mixtures.
    b. Demonstrate an understanding of hue, saturation and brightness.
    c. Demonstrate an understanding of complimentary colors and composition.
    d. Identify warm and cool colors.
    e. Demonstrate an understanding of the psychology of color influence.

This standard supports the following Next Generation Sunshine State Standards: MA.912.A.1.5, MA.912.A.2.1, 2; MA.912.G.2.7; MA.912.G.5.4; MA.912.G.6.2, 4, 5

n. **Standard** Demonstrate knowledge of 3D paint–The student will be able to:
    a. Identify available 3D paint programs
    b. Demonstrate knowledge of UV mapping tools.
    c. Demonstrate knowledge of UV unwrapping and organizational techniques.
    d. Prepare a UV map for export for use with photo editing software.
    e. Demonstrate knowledge of 3D painting tools within 3D software.
    f. Apply painted image map to model.

This standard supports the following Next Generation Sunshine State Standards: MA.912.G.7.5, 6, 7

o. **Standard** Demonstrate knowledge of rigging–The student will be able to:
    a. Review rigging as a process.

b. Review the role of rigger.
c. Review job titles associated with a rigger.
d. Review rigging creation in the production pipeline.
e. Demonstrate knowledge of forward kinematics vs. inverse kinematics
f. Demonstrate an understanding of the joint weighting process
g. Demonstrate the proper hierarchical structure of goals and nulls to construct effective control objects.

p. **Standard** Demonstrate knowledge of video editing software--The student will be able to:
    a. Demonstrate understanding file formats and storage options.
    b. Identify parts of the software interface. (menus/palettes)
    c. Demonstrate ability to use each of the basic tool sets.
    d. Demonstrate ability to import, export and save video.
    e. Demonstrate understanding of layers and compositing.
    f. Demonstrate understanding of filters, effects and plug-ins.
    g. Demonstrate understanding of file presets.
    h. Demonstrate understanding of rendering process.
    i. Demonstrate ability to transform video (crop, scale).
    j. Demonstrate ability to color correct images (brightness, hue, contrast)
    k. Demonstrate ability to use brushes for image creation and correction.
    l. Understand non-destructive and destructive operations.
    m. Demonstrate the compositing integration of rendered 3D animation with video.
q. **Standard** Understand modeling in relation to the production process--The student will be able to:
    a. This standard supports the following Next Generation Sunshine State Standards: MA.912.S.3.1
    b. Define modeling as a process.
    c. Define the role of modeler.
    d. Identify job titles associated with modeler.
    e. Identify modeling in the production pipeline.
r. **Standard** Demonstrate knowledge of NURBS modeling--The student will be able to:
    a. Demonstrate an understanding of points, vertices, edges, and polygons.
    b. Demonstrate an understanding of poly-count.
    c. Demonstrate an understanding of primitives.
    d. Define parametric primitives.
    e. Locate an object's properties, attributes, and coordinates.
    f. Demonstrate understanding of Non uniform rational b-splines (NURBS).
    g. Demonstrate understanding of splines and generators (extrude, lathe, sweep).
    h. Understand the use of hierarchy.
    i. Demonstrate an understanding of Boolean objects.
    j. Demonstrate an understanding of Null objects.
    k. Demonstrate an understanding of scene management (hiding-unhiding).
    l. Demonstrate an understanding of arrays.
s. **Standard** Demonstrate an understanding of basic materials and textures--The student will be able to:

a. Demonstrate an understanding of material and texture storage.
b. Apply textures to an object.
c. Demonstrate an understanding of procedural shaders.
d. Demonstrate an understanding of channels.
e. Adjust the transparency, luminance, and reflection of a material.
f. Demonstrate an understanding of displacement maps.
g. Demonstrate an understanding of bump maps.
h. Demonstrate knowledge of material projections.
i. Demonstrate an understanding of UV mapping.
j. Demonstrate an understanding of 3D painting.
k. Understand how light affects the look of materials.
l. Understand how camera angles can affect the look of materials.

t. **Standard** Demonstrate knowledge of basic 3D rendering–The student will be able to:
    a. Review processor, hardware and software rendering techniques.
    b. Review the final render format (size, codec, quality).
    c. Review an understanding of basic render settings.
    d. Demonstrate an understanding of title safe, action safe, render safe.
    e. Select the range of frames to be rendered.
    f. Demonstrate an understanding of global illumination (radiosity) render settings.
    g. Demonstrate an understanding of anti-aliasing.
    h. Demonstrate an understanding of net rendering.
    i. Demonstrate an understanding of alpha channels.
    j. Render animation as a movie or image sequence.
    k. Compile image sequence into a movie.
    l. Demonstrate an understanding of benefits, purpose and workflow of multi-pass rendering.
    m. Demonstrate an understanding of the batch render process.
u. **Standard** Understand the role of texture artist in relation to the production process--The student will be able to:
    a. Define texturing as a process.
    b. Define the role of texture artist.
    c. Identify job titles associated with texture artist.
    d. Identify texture creation in the production pipeline.
    e. Demonstrate knowledge of the difference between textures and shaders.
    f. Demonstrate an understanding of texture projection methods.
    g. Demonstrate an understanding on UV coordinates and their application to texture mapping.
    h. Demonstrate an understanding of the round-trip integration of Photoshop and a 3D host for texture development.
    i. Demonstrate an understanding of how to link texture and shader properties to object movement via either visual or scripted programming relationships.
v. **Standard** Demonstrate knowledge color theory--The student will be able to:
    a. Demonstrate an understanding of additive and subtractive color mixtures.
    b. Demonstrate an understanding of hue, saturation and brightness.
    c. Demonstrate an understanding of complimentary colors and composition.

d. Identify warm and cool colors.
e. Demonstrate an understanding of the psychology of color influence.

w. **Standard** Demonstrate knowledge of 3D paint–The student will be able to:
   a. Identify available 3D paint programs
   b. Demonstrate knowledge of UV mapping tools.
   c. Demonstrate knowledge of UV unwrapping and organizational techniques.
   d. Prepare a UV map for export for use with photo editing software.
   e. Demonstrate knowledge of 3D painting tools within 3D software.
   f. Apply painted image map to model.

x. **Standard** Demonstrate knowledge of rigging–The student will be able to:
   a. Review rigging as a process.
   b. Review the role of rigger.
   c. Review job titles associated with a rigger.
   d. Demonstrate rigging creation in the production pipeline.
   e. Demonstrate knowledge of forward kinematics vs. inverse kinematics
   f. Demonstrate an understanding of the joint weighting process
   g. Demonstrate the proper hierarchical structure of goals and nulls to construct effective control objects.

y. **Standard** Demonstrate knowledge of basic 3D rendering–The student will be able to:
   a. Demonstrate an understanding of title safe, action safe, render safe.
   b. Demonstrate an understanding of global illumination (radiosity) render settings.
   c. Demonstrate an understanding of anti-aliasing.
   d. Demonstrate an understanding of net rendering.
   e. Demonstrate an understanding of alpha channels.
   f. Render animation as a movie or image sequence.
   g. Compile image sequence into a movie.
   h. Demonstrate an understanding of benefits, purpose and workflow of multi-pass rendering.
   i. Demonstrate an understanding of the batch render process.

z. **Standard** Understand the role of texture artist in relation to the production process--The student will be able to:
   a. Demonstrate an understanding of texture projection methods.
   b. Demonstrate an understanding on UV coordinates and their application to texture mapping.
   c. Demonstrate an understanding of the round-trip integration of Photoshop and a 3D host for texture development.
   d. Demonstrate an understanding of how to link texture and shader properties to object movement via either visual or scripted programming relationships.

aa. **Standard** Demonstrate knowledge color theory--The student will be able to:
   a. Demonstrate an understanding of additive and subtractive color mixtures.
   b. Demonstrate an understanding of hue, saturation and brightness.
   c. Demonstrate an understanding of complimentary colors and composition.
   d. Identify warm and cool colors.
   e. Demonstrate an understanding of the psychology of color influence.

bb. **Standard** Demonstrate knowledge of 3D paint–The student will be able to:

a. Identify available 3D paint programs
b. Demonstrate knowledge of UV mapping tools.
c. Demonstrate knowledge of UV unwrapping and organizational techniques.
d. Prepare a UV map for export for use with photo editing software.
e. Demonstrate knowledge of 3D painting tools within 3D software.
f. Apply painted image map to model.

Standard Demonstrate knowledge of rigging–The student will be able to:

g. Demonstrate knowledge of forward kinematics vs. inverse kinematics
h. Demonstrate an understanding of the joint weighting process
i. Demonstrate the proper hierarchical structure of goals and nulls to construct effective control objects.

cc. Audio

a. Perform various job roles typical for an audio technician on a game/ simulation project. – The student will be able to:
    i. Identify the job titles of audio technicians and artists typically involved in a game project.
    ii. Work as part of a sound design team.
b. Demonstrate basic audio production. – The student will be able to:
    i. Describe digital audio storage concepts and digital storage media.
    ii. Operate digital recording decks and other digital storage devices.
    iii. Describe the function and operation of digital audio workstations.
    iv. Edit, cut, erase, and insert sound utilizing various digital production techniques.
    v. Perform digital noise reduction and noise extraction via spectral display.

dd. Incorporate audio assets into game/simulation engine. – The student will be able to:

a. Describe the audio effects workflow.
b. Explain audio codecs and formats used in game/simulation engines.
c. Import audio into the game/simulation engine
d. Use appropriate naming conventions for audio assets.
e. Describe the use of 3D and surround sound.
f. Apply knowledge of distance/spatial effects including surround sound in a game/simulation.
g. Contrast the audio environment as it relates to the visual environment

YEAR 4
****VISUAL****

VI. Modeling and Simulation Advanced Applications – Capstone Project - Visual

Course Description:

This course is focused on students acquiring the appropriate programming skills for rendering a modeling and simulation product, including visual simulation and engineering logistics, and implementation issues specific to modeling and simulation products.

LACC.1112.RST.1.3: Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

LACC.910.RST.1.1: Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.

LACC.910.RST.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.

LACC.1112.WHST.1.2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

LACC.1112.RST.2.4: 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.

LACC.910.RST.2.5: Analyze the structure of the relationships among concepts in a text, including

relationships among key terms (e.g., 2D, 3D, visual models, software programs).

LACC.1112.RST.3.7: 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.

LACC.910.RST.3.7: 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.

LACC.1112.WHST.3.9: Draw evidence from informational texts to support analysis, reflection, and research.

LACC.1112.RST.4.10: By the end of grade 12, read and comprehend science/technical texts in the grades 11–12 text complexity band independently and proficiently.

MACC.912.N-Q.1.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

MACC.912.N-Q.1.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

MACC.912.S-IC.2.3: Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

MACC.912.S-IC.2.6: Evaluate reports based on data.

MACC.912.F-IF.3.7: Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Florida Essential Skills

The essential skills listed in this document are being integrated into the standards and benchmarks of the secondary and post secondary Career and Technical Education programs maintained by the Florida Department of Education, Division of Career and Adult Education. They are the knowledge and skills essential to success for careers in all career clusters. Students preparing for careers at any level should be able to demonstrate this knowledge and these skills in the context of their chosen cluster and career path.

ACADEMIC FOUNDATIONS (AF)

01.0	Demonstrate language arts knowledge and skills. – The student will be able to:		AF 2.0
	01.01	Locate, comprehend and evaluate key elements of oral and written information.	AF2.4
	01.02	Draft, revise, and edit written documents using correct grammar, punctuation and vocabulary.	AF2.5
	01.03	Present information formally and informally for specific purposes and audiences.	AF2.9
02.0	Demonstrate mathematics knowledge and skills. – The student will be able to:		AF3.0
	02.01	Demonstrate knowledge of arithmetic operations.	AF3.2
	02.02	Analyze and apply data and measurements to solve problems and interpret documents.	AF3.4
	02.03	Construct charts/tables/graphs using functions and data.	AF3.5
03.0	Demonstrate science knowledge and skills. – The student will be able to:		AF4.0
	03.01	Discuss the role of creativity in constructing scientific questions, methods and explanations.	AF4.1
	03.02	Formulate scientifically investigable questions, construct investigations, collect and evaluate data, and develop scientific recommendations based on findings.	AF4.3

COMMUNICATIONS (CM)

01.0	Use oral and written communication skills in creating, expressing and interpreting information and ideas. – The student will be able to:		
	01.01	Select and employ appropriate communication concepts and strategies to enhance oral and written communication in the workplace.	CM 1.0
	01.02	Locate, organize and reference written information from various sources.	CM 3.0
	01.03	Design, develop and deliver formal and informal presentations using appropriate media to engage and inform diverse audiences.	CM 5.0
	01.04	Interpret verbal and nonverbal cues/behaviors that enhance communication.	CM 6.0
	01.05	Apply active listening skills to obtain and clarify information.	CM 7.0
	01.06	Develop and interpret tables and charts to support written and oral communications.	CM 8.0
	01.07	Exhibit public relations skills that aid in achieving customer satisfaction.	CM 10.0

EMPLOYABILITY AND CAREER DEVELOPMENT (ECD)

01.0 Explain the importance of employability skill and entrepreneurship skills. – The student will be able to:

01.01	Identify and demonstrate positive work behaviors needed to be employable.	ECD 1.0
01.02	Develop personal career plan that includes goals, objectives, and strategies.	ECD 2.0
01.03	Examine licensing, certification, and industry credentialing requirements.	ECD 3.0
01.04	Maintain a career portfolio to document knowledge, skills, and experience.	ECD 5.0
01.05	Evaluate and compare employment opportunities that match career goals.	ECD 6.0
01.06	Identify and exhibit traits for retaining employment.	ECD 7.0
01.07	Identify opportunities and research requirements for career advancement.	ECD 8.0
01.08	Research the benefits of ongoing professional development.	ECD 9.0
01.09	Examine and describe entrepreneurship opportunities as a career planning option.	ECD 10.0

ETHICS AND LEGAL RESPONSIBILITIES (ELR)

01.0 Describe the importance of professional ethics and legal responsibilities. – The student will be able to:

01.01	Evaluate and justify decisions based on ethical reasoning.	ELR 1.0
01.02	Evaluate alternative responses to workplace situations based on personal, professional, ethical, legal responsibilities, and employer policies.	ELR1.1
01.03	Identify and explain personal and long-term consequences of unethical or illegal behaviors in the workplace.	ELR1.2
01.04	Interpret and explain written organizational policies and procedures.	ELR 2.0

FINANCIAL LITERACY (FL)

01.0 Demonstrate personal money-management concepts, procedures, and strategies. – The student will be able to:

01.01	Identify and describe the services and legal responsibilities of financial institutions.	FL 2.0
01.02	Describe the effect of money management on personal and career goals.	FL 3.0
01.03	Develop a personal budget and financial goals.	FL3.1
01.04	Complete financial instruments for making deposits and withdrawals.	FL3.2
01.05	Maintain financial records.	FL3.3
01.06	Read and reconcile financial statements.	FL3.4
01.07	Research, compare and contrast investment opportunities.	

INFORMATION TECHNOLOGY APPLICATIONS (IT

01.0 Use information technology tools. – The student will be able to:

01.01	Use personal information management (PIM) applications to increase workplace efficiency.	IT 1.0
01.02	Employ technological tools to expedite workflow including word processing, databases, reports, spreadsheets, multimedia presentations, electronic calendar, contacts, email, and internet applications.	IT 2.0
01.03	Employ computer operations applications to access, create, manage, integrate, and store information.	IT 3.0
01.04	Employ collaborative/groupware applications to facilitate group work.	IT 4.0

LEADERSHIP AND TEAMWORK (LT)

01.0 Demonstrate leadership and teamwork skills needed to accomplish team goals and objectives. – The student will be able to:

01.01	Employ leadership skills to accomplish organizational goals and objectives.	LT1.0
01.02	Establish and maintain effective working relationships with others in order to accomplish objectives and tasks.	LT3.0
01.03	Conduct and participate in meetings to accomplish work tasks.	LT 4.0
01.04	Employ mentoring skills to inspire and teach others.	LT 5.0

PROBLEM-SOLVING AND CRITICAL THINKING (PS)

01.0 Solve problems using critical thinking skills, creativity and innovation. – The student will be able to:

01.01	Employ critical thinking skills independently and in teams to solve problems and make decisions.	PS1.0
01.02	Employ critical thinking and interpersonal skills to resolve conflicts.	PS 2.0
01.03	Identify and document workplace performance goals and monitor progress toward those goals.	PS 3.0
01.04	Conduct technical research to gather information necessary for decision-making.	PS 4.0

SAFETY, HEALTH AND ENVIRONMENTAL (SHE)

01.0 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:

01.01	Describe personal and jobsite safety rules and regulations that maintain safe and healthy work environments.	SHE 1.0
01.02	Explain emergency procedures to follow in response to workplace accidents.	
01.03	Create a disaster and/or emergency response plan.	SHE 2.0

SYSTEMS (SY)

01.0 Describe the roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. – The student will be able to:

01.01	Describe the nature and types of business organizations.	SY 1.0
01.02	*Explain the effect of key organizational systems on performance and quality.*	
01.03	List and describe quality control systems and/or practices common to the workplace.	SY 2.0
01.04	*Explain the impact of the global economy on business organizations.*	