Florida Department of Education
Curriculum Framework

Program Title: **Agriculture Biotechnology**
Program Type: **Career Preparatory**
Career Cluster: **Agriculture, Food and Natural Resources**

Program Number	8003100
CIP Number	0126120101
Grade Level	9-12
Program Length	5 credits
Teacher Certification	Refer to the **Program Structure** section
CTSO	FFA
SOC Codes (all applicable)	19-4021 -- Biological Technicians 19-1011 -- Animal Scientists 19-1013 -- Soil and Plant Scientists
CTE Program Resources	http://www.fldoe.org/academics/career-adult-edu/career-tech-edu/program-resources.stml

Purpose

This program offers a sequence of courses that provides coherent and rigorous content aligned with challenging academic standards and relevant technical knowledge and skills needed to prepare for further education and careers in the Agriculture, Food and Natural Resources (AFNR) 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 Agriculture, Food and Natural Resources career cluster.

The content includes but is not limited to planning, management, finance, technical and production skills, underlying principles of technology, labor issues, community issues and health, safety and environmental issues.

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

Program Structure

This program is a planned sequence of instruction consisting of five credits. Planned and Supervised Agricultural Experiences (SAE) must be provided through one or more of the following: (1) foundational career exploration, (2) directed laboratory experience, (3) project ownership/entrepreneurship, (4) cooperative education/internship, (5) School Based Enterprise, or (6) Service Learning.
To teach the course(s) listed below, instructors must hold at least one of the teacher certifications indicated for that course.

The following table illustrates the secondary program structure:

Course Number	Course Title		Length	SOC Code	Level	Graduation Requirement
8106810	Agriscience Foundations 1	AGRICULTURE 7 G AGRICULTUR 1 @2	1 credit		3	EQ
8106850	Agricultural Biotechnology 2	AGRICULTURE 7 G AGRICULTUR 1 @2	1 credit	19-4021	3	CT
8106860	Agricultural Biotechnology 3		1 credit	19-4021	3	EQ
8106120	Animal Biotechnology		1 credit	19-1011	3	CT
8106510	Plant Biotechnology		1 credit	19-1013	3	CT

(Graduation Requirement Codes: CT= Career & Technical Education, EQ= Equally Rigorous Science, EC= Economics, MA= Mathematics, PL= Personal Financial Literacy)

National Standards (NS): Council for Agricultural Education

Some or all of the courses in this program have been aligned with National Standards AFNR Standards from the Council for Agricultural Education. If so, the standards have been identified and cross walked with the corresponding CTE standard and/or benchmark. National Standards can be found by accessing the following link: https://ffa.app.box.com/v/Library/folder/52815452676.

Common Career Technical Core – Career Ready Practices

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

1. Act as a responsible and contributing citizen and employee.

2. Apply appropriate academic and technical skills.

3. Attend to personal health and financial well-being.

4. Communicate clearly, effectively and with reason.

5. Consider the environmental, social and economic impacts of decisions.

6. Demonstrate creativity and innovation.

7. Employ valid and reliable research strategies.

8. Utilize critical thinking to make sense of problems and persevere in solving them.

9. Model integrity, ethical leadership and effective management.

10. Plan education and career path aligned to personal goals.

11. Use technology to enhance productivity.

12. Work productively in teams while using cultural/global competence.

Standards

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

Agriscience Foundations 1

1.0 Examine the history of AFNR production at the local, national, and global level.
2.0 Employ scientific reasoning to make informed decisions in AFNR systems.
3.0 Apply scientific skills and principles in natural resources.
4.0 Apply scientific skills and principles in plant science.
5.0 Apply scientific skills and principles in animal science.
6.0 Apply scientific skills and principles in food science.
7.0 Apply scientific skills and principles in power, structure, and technical systems.
8.0 Explore AFNR professional development organizations.

Agricultural Biotechnology 2

9.0 Identify the historical, social, cultural and potential applications of biotechnology.
10.0 Conduct scientific investigation and apply results.
11.0 Practice agricultural laboratory safety.
12.0 Apply genetic principles to agricultural production.
13.0 Demonstrate laboratory skills as applied to biotechnology.
14.0 Demonstrate the application of biotechnology to AFNR.

Agricultural Biotechnology 3

15.0 Recognize and follow quality control procedures and regulatory guidelines.
16.0 Analyze the historical, social, cultural and potential applications of biotechnology.
17.0 Demonstrate proper tissue/cell culture techniques.
18.0 Demonstrate the application of biotechnology to the AFNR industries.
19.0 Demonstrate leadership, employability, communication and human relation skills.

Animal Biotechnology

20.0 Apply genetic principles to animal science.
21.0 Interpret the relationship between total digestible nutrients (TDN) in feeds and its utilization.
22.0 Examine the developmental processes that determine animal growth.
23.0 Investigate the reproduction system of animals.
24.0 Describe animal science and the role of animals in society.

Plant Biotechnology

25.0 Describe plant classifications and the economic impact to your region.
26.0 Apply genetic principles to plant improvement.

27.0 Demonstrate methods of micropropagating plants.
28.0 Demonstrate methods of plant production.
29.0 Use plants to demonstrate growth disorders (nutrients, pathogens, pests).
30.0 Identify the historical, social, cultural and potential applications of plant biotechnology.

Florida Department of Education
Student Performance Standards

Course Title: **Agriscience Foundations 1**
Course Number: **8106810**
Course Credit: **1**

Course Description:

This course is designed to develop competencies in the areas of agricultural history and the global impact of agriculture; career opportunities; scientific and research concepts; biological and physical science principles; environmental principles; agriscience safety; principles of leadership; and agribusiness, employability, and human relations skills in agriscience. Laboratory-based activities are an integral part of this course. These include the safe use and application of appropriate technology, scientific testing and observation equipment.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

Agriscience Foundations 1 (8106810) is part of several programs across the Agriculture, Food & Natural Resources career cluster. To ensure consistency, the standards and benchmarks for this course (01.0 – 8.0) have been placed in a separate document. To access this document, visit: https://www.fldoe.org/core/fileparse.php/20706/urlt/Agsci-Fnds1-Core-2425.rtf

Florida Department of Education
Student Performance Standards

Course Title: **Agricultural Biotechnology 2**
Course Number: **8106850**
Course Credit: **1**

Course Description:

This course was developed as a core and is designed to develop competencies in the areas of agricultural biotechnology in agriculture, scientific investigation, laboratory safety, scientific and technological concepts, and the fundamentals of biotechnology.

CTE Standards and Benchmarks			National Standards
1.0	Identify the historical, social, cultural and potential applications of biotechnology. The student will be able to:		
	1.1	Define biotechnology and explore the historical impact on agriculture.	
	1.2	Analyze the developmental progression of biotechnology and the evolution of scientific knowledge	BS.01.01.01.b
	1.3	Distinguish between current and emerging applications of biotechnology in agriculture.	BS.01.01.03.a
	1.4	Explain the relationship between regulatory agencies and the protection of public interests such as health, safety, and the environment.	BS.01.02.03.a
	1.5	Compare and contrast differences between regulatory systems worldwide.	BS.01.02.01.b
	1.6	Research and document major regulatory issues related to biotechnology in agriculture.	BS.01.02.02.a
	1.7	Explore ethical, legal, and social biotechnology issues.	
	1.8	Evaluate the short-term and long-term benefits and risks of applying biotechnology to agriculture.	BS.01.01.04.c
	1.9	Investigate the emergence and evolution of biological organisms and their use in biotechnology.	
	1.10	Research and summarize legal issues related to biotechnology in agriculture (e.g., protection of intellectual property through patents, copyright, trademarks, …)	BS.01.03.02.a
	1.11	Devise and support an argument for or against an ethical issue associated with biotechnology in agriculture.	BS.01.03.01.c
2.0	Conduct scientific investigation and apply results. The student will be able to:		
	2.1	Discuss the differences between scientific laws and scientific theories.	
	2.2	Design an agricultural experiment using appropriate control measures.	
	2.3	Collect and record data using SI units.	
	2.4	Using the scientific method summarize data, draw conclusions, and plan follow-up experiments.	
3.0	Practice agricultural laboratory safety. The student will be able to:		
	3.1	Identify first aid supplies, personnel and emergency protection areas.	
	3.2	Monitor, use, store and dispose of hazardous materials and disposal of biological pathogens according to industry practices.	
	3.3	Document safety training and practices (reading and interpreting) using Safety Data Sheets (SDS) and Occupational Safety and Health Administration (OSHA) standards.	

	3.4 Demonstrate and utilize safety equipment.	
	3.5 Identify safety symbols and signs.	
	3.6 Demonstrate appropriate safety procedures and guidelines and discuss implications of safety violations.	
4.0	Apply genetic principles to agricultural production. The student will be able to:	
	4.1 Describe the relationship between reproduction and genetic improvement.	
	4.2 Demonstrate how traits are inherited.	
	4.3 Describe how genetic processes and structures control inheritance.	
	4.4 Predict probable results of single or multiple trait crosses.	
	4.5 Differentiate between dominant and recessive traits.	
	4.6 Compare and contrast the structures of DNA and RNA and how they are manipulated.	BS.02.05.02.a
	4.7 Investigate how genotype influences phenotype.	
	4.8 Hypothetically develop a genetic engineered species to solve an agriculture problem.	
	4.9 Assess and debate the pros and cons of transgenic species in agriculture	BS.03.01.02.b
	4.10 Perform DNA manipulations, such as cloning/subcloning, blotting, sequencing, and amplification.	
	4.11 Analyze factors that influence gene expression.	
	4.12 Describe the process of genetic marker assisted selection.	
5.0	Demonstrate laboratory skills as applied to biotechnology. The student will be able to:	
	5.1 Maintain and interpret laboratory and production records documented in a laboratory to ensure data accuracy and integrity	BS.02.01.01.b
	5.2 Manipulate basic laboratory equipment and measurement devices.	BS.02.02.02.b
	5.3 Demonstrate advanced aseptic techniques in the biotechnology laboratory.	BS.02.03.01.b
	5.4 Analyze and select an appropriate standard operating procedure for working with biological materials based upon their classification.	BS.02.03.02.b
	5.5 Formulate and prepare solutions using standard operating procedures (e.g., buffers, reagents, solutions, and media).	BS.02.03.03.b
	5.6 Inventory biological and chemical materials and maintain accurate records of supplies and expiration dates.	BS.02.04.02.b
	5.7 Isolate, maintain, quantify, and store cell cultures.	
	5.8 Analyze and interpret the molecular basis for heredity and the tools and techniques used	BS.02.05.02.b
	5.9 Extract and purify DNA and RNA according to standard operating procedures.	BS.02.05.03.a
	5.10 Demonstrate protein separation techniques and interpret the results.	BS.02.05.04.b
	5.11 Analyze and document how antibodies are formed and describe how they can be used in agriculture biotechnology.	BS.02.05.05.b
	5.12 Summarize reasons for detecting microbes and identify sources of microbes.	BS.03.02.01.a
6.0	Demonstrate the application of biotechnology to AFNR. The student will be able to:	
	6.1 Explain biological, social, agronomic, and economic reasons for genetic engineering of eukaryotes and prokaryotes.	BS.03.01.01.a
	6.2 Differentiate the roles of carbohydrates, fats, and proteins in biotechnology applications.	
	6.3 Describe the role of fermentation in biotechnology applications.	

6.4	Analyze and document the processes and describe the techniques used to produce transgenic eukaryotes.	BS.03.01.01.b
6.5	Examine enzymes, the changes they cause in foods and the physical and chemical parameters that affect enzymatic reactions.	BS.03.02.02.a
6.6	Describe how enzymatic reactions can be used in biotechnology based assays.	
6.7	Analyze processes by which enzymes are produced through biotechnology.	BS.03.02.02.b
6.8	Compare and contrast the use of natural organisms and genetically engineered organisms in the treatment of wastes.	
6.9	Analyze the process by which organisms are genetically engineered for waste treatment.	BS.03.06.01.b
6.10	Investigate and report on genetic engineering procedures used in the production of agricultural products.	
6.11	Explain the functions of hormones in animals.	
6.12	Describe the processes used to produce animal hormones from transgenic organisms.	
6.13	Identify foods produced through fermentation.	
6.14	Compare and contrast bioengineering and conventional pathways used in food processing.	
6.15	Explain biomass and sources of biomass.	
6.16	Assess the characteristics of biomass that make it useful for biofuels production.	BS.03.05.02.b
6.17	Correlate the relationship between fermentation and the process used to produce alcohol from biomass.	BS.03.05.03.b
6.18	Analyze and document the process to produce biodiesel from biomass.	BS.03.05.04.b
6.19	Analyze and describe the process used to produce methane from biomass.	BS.03.05.05.b
6.20	Research and describe the aims and techniques involved in selective plant and animal breeding process.	BS.03.04.01.a

Florida Department of Education
Student Performance Standards

Course Title: **Agricultural Biotechnology 3**
Course Number: **8106860**
Course Credit: **1**

Course Description:

This course is designed to enhance competencies in the areas of current agricultural biotechnology applications, genetic principles, tissue/cell culture, and the potential for biotechnology in the area of agriculture.

Laboratory investigations that include scientific inquiry, research, measurement, problem solving, emerging technologies, tools and equipment, as well as, experimental quality, and safety procedures will be an integral part of this course. Students will interact with materials and primary sources of data or with secondary sources of data to observe and understand the natural world. Students will develop an understanding of measurement error, and develop the skills to aggregate, interpret, and present the data and resulting conclusions. Equipment and supplies will be provided to enhance these hands-on experiences for students. A minimum of 20% of classroom time will be dedicated to laboratory experiences.

CTE Standards and Benchmarks			National Standards
1.0	Recognize and follow quality control procedures and regulatory guidelines. The student will be able to:		
	1.1	Design and conduct an experiment using tools to evaluate biotechnology derived products.	
	1.2	Assess and summarize the role and scope of agencies that regulate biotechnology.	BS.01.02.01.b
	1.3	Discuss quality control as it relates to products, safety, quality to the end user, and meeting regulatory specifications.	
	1.4	Perform quality control methods utilizing proper documentation.	
	1.5	Conduct a polymerase chain reaction to determine the presence of genetic modifications in a common food item.	
	1.6	Troubleshoot aberrant results or parameters.	
2.0	Analyze the historical, social, cultural, and potential applications of agricultural biotechnology. The student will be able to:		
	2.1	Research and report on the major innovators and milestones in the development of biotechnology.	
	2.2	Assess and summarize current work in biotechnology being done to add value to agriculture and global society.	BS.01.01.02.b
	2.3	Explain and critique a decision made by a major agency that regulates agriculture biotechnology.	BS.01.02.01.c
	2.4	Research and summarize the emergence, evolution and implications of bioethics associated with biotechnology in agricultural production.	BS.01.03.01.a
	2.5	Analyze the implications bioethics may have on future advancements in AFNR	BS.01.03.01.b
	2.6	Analyze an intellectual property issue associated with bioethics in agricultural production.	

2.7	Identify and discuss emerging technologies in agriculture production (transgenics, biologics, biosecurity, food safety, sustainability, etc.).	
2.8	Use web-based resources to find information on the genetic sequence of a protein using bioinformatics.	
3.0	Demonstrate proper tissue/cell culture techniques. The student will be able to:	
3.1	Conduct assays and experiments under aseptic conditions.	BS.02.03.01.c
3.2	Describe the effects of growth hormones on tissue/cell culture.	
3.3	Perform sterilization techniques for equipment in a laboratory using standard operating procedures.	BS.02.02.03.c
3.4	Produce plants using tissue culture methods and prepare a written report of data and results.	BS.03.04.01.c
4.0	Demonstrate the application of biotechnology to the AFNR industries. The student will be able to:	
4.1	Create a standard operating procedure for a biological process.	BS.02.03.02.c
4.2	Perform ongoing maintenance of laboratory equipment according to the standard operating procedures (e.g., calibration, testing, etc.)	BS.02.02.02.01.c
4.3	Simulate inventory control using processes such as material quarantine and release, the FIFO (first in first out) system, expiration dating, and proper storage methods for biologics and chemicals.	
4.4	Summarize what happens to different types waste after it leaves the laboratory and identify opportunities to reduce waste and unnecessary costs. (e.g., Biohazardous, toxic, pathogenic.)	BS.02.04.03.a
4.5	Evaluate the biochemical properties of proteins to explain their function and predict potential uses.	BS.02.05.04.c
4.6	Use antibodies to detect and quantify antigens by conducting an Enzyme-Linked Immunosorbent Assay (ELISA).	BS.02.05.05.c
4.7	Produce ethanol and co-products from biomass.	BS.03.05.03.c
4.8	Produce biodiesel and co-products from biomass.	BS.03.05.04.c
4.9	Produce methane and co-products from biomass.	BS.03.05.05.c
4.10	Evaluate the technologies used to create biofuels from biomass.	
4.11	Discuss (or demonstrate) algae growth (culture to large scale) for biofuel production.	
4.12	Describe the principles (purpose) of centrifugation and filtration.	
4.13	Assess the benefits, risks and opportunities associated with using biotechnology to promote animal health.	BS.03.04.02.b
4.14	Analyze and summarize the risks and benefits of using biotechnology for bioremediation.	BS.03.06.04.b
4.15	Analyze the role of microorganisms in industrial chemical waste treatment.	BS.03.06.03.a
4.16	Explain the global importance of biodiversity.	
4.17	Explain the positive and negative impacts of agricultural practices on wild populations.	
4.18	Analyze how biotechnology tools can be used to monitor the effects of agricultural practices on wild populations.	BS.03.03.01.b
4.19	Describe the processes used in the production of molecules for use in industrial applications.	BS.03.03.02.b
5.0	Demonstrate leadership, employability, communication and human relation skills. The student will be able to:	
5.1	Conduct group meetings using parliamentary procedure and public speaking skills.	
5.2	Follow acceptable work habits, personal characteristics, and hygiene habits for the biotechnology workplace.	

5.3	Identify or demonstrate appropriate responses to criticism and coaching from employer, supervisor, or other persons.	
5.4	Demonstrate appropriate methods for asking questions and providing constructive criticism and feedback.	
5.5	Conduct a job search and identify advanced training opportunities and the requirements.	
5.6	Update current resume.	
5.7	Demonstrate appropriate methods for asking questions, and providing constructive criticism and feedback to supervisor, employer, supervisor, or other persons.	

Florida Department of Education
Student Performance Standards

Course Title: **Animal Biotechnology**
Course Number: **8106120**
Course Credit: **1**

Course Description:

This course is designed to develop competencies in the areas of biotechnology in animal science, animal growth and reproduction, and the role of animals in society.

CTE Standards and Benchmarks		National Standards
6.0	Apply genetic principles to animal science. The student will be able to:	
6.1	Describe how the concept of heritability is used in the selection of livestock.	
6.2	Chart the difference between phenotypic and genotypic characteristics and determine probabilities.	
6.3	Analyze performance data used in the selection process of livestock. (EPDs).	
6.4	Use computer data to assist in the selection process of livestock.	
6.5	Extract a visible mass of DNA from animal tissue.	
6.6	Develop a hypothetical species using genetic engineering.	
6.7	Debate the safeguards used in research in genetic engineering.	
7.0	Interpret the relationship between total digestible nutrients (TDN) in feeds and its utilization. The student will be able to:	
7.1	Determine nutritional requirements of selected animals.	
7.2	Select appropriate feed samples for analysis of nutritional values and develop a balanced ration.	
7.3	Conduct experiments comparing growth rates using selected rations.	
7.4	Compare how the body's cells metabolize fats, carbohydrates, and proteins.	
7.5	Analyze the effect of diseases on nutritional utilization.	
8.0	Examine the developmental processes that determine animal growth. The student will be able to:	
8.1	Develop a growth curve using selected animal species.	
8.2	Differentiate between muscle, fat, and bone development.	
8.3	Evaluate the effects of hormones in animal production.	
8.4	Compare morphology of developing embryos.	
8.5	Analyze the diseases that affect development growth.	
9.0	Investigate the reproduction system of animals. The student will be able to:	
9.1	Analyze the quality of semen of selected animals.	
9.2	Compare and contrast sperm anatomy of selected animal species.	
9.3	Analyze the factors that affect sperm mobility and development.	

	9.4	Compare and contrast the reproductive cycles of selected animal species.	
	9.5	Compare and contrast the breeding time and conception rates of selected animal species.	
	9.6	Describe the functions of hormones that control reproduction.	
	9.7	Discuss the use of hormone therapy to manipulate ovarian activity.	
	9.8	Describe and compare the different pathogens that cause animal diseases.	
	9.9	Analyze environmental factors the affect growth and development.	
	9.10	Analyze the mating process of selected animal species.	
10.0	Describe animal science and the role of animals in society. The student will be able to:		
	10.1	Debate current events concerning animal welfare and animal rights.	
	10.2	Demonstrate safe procedures when working with animal related equipment in laboratory settings.	
	10.3	Practice safety precautions around animals.	
	10.4	Develop a research project related to biotechnology and animal science.	
	10.5	Discuss the benefits of biotechnology in producing and marketing animals and animal products.	
	10.6	Research how biotechnology affects the consumer.	

Florida Department of Education
Student Performance Standards

Course Title: **Plant Biotechnology**
Course Number: **8106510**
Course Credit: **1**

Course Description:

This course is designed to develop competencies in the areas of biotechnology in plant science, growth and reproduction, and the role of plants in biotechnology.

CTE Standards and Benchmarks		National Standards
1.0	Describe plant classifications and the economic impact to your region. The student will be able to:	
1.1	Classify plants based upon their regional use and importance.	
1.2	Describe the economic impact of regionally produced products.	
1.3	Describe factors influencing the feasibility of plant products and approaches toward achieving food sustainability within a region or community.	
1.4	Identify economically significant plant families.	
1.5	Identify at least fifty plants by common and scientific names.	
2.0	Apply genetic principles to plant improvement. The student will be able to:	
2.1	Describe the relationship between reproduction and plant improvement.	
2.2	Demonstrate the reproductive cycle in seed plants, angiosperms and gymnosperms, mosses, and ferns.	
2.3	Describe how genetic processes and structures control inheritance in plants.	
2.4	Explain polyploidy in both natural settings and in commercial plant production.	
2.5	Differentiate phenotypic versus genotypic expression in plant crosses.	
2.6	Describe the processes used for mutation induction.	
3.0	Demonstrate methods of micropropagating plants. The student will be able to:	
3.1	Evaluate the advantages and disadvantages of using micropropagation techniques.	
3.2	Demonstrate aseptic/sterile technique.	
3.3	Prepare and mix stock solutions of media for micro-propagation.	
3.4	Produce a crop using tissue culture methods and prepare a written report of results.	
3.5	Propagate plants using tissue culture techniques for producing synthetic seed culture.	
3.6	Develop and write a protocol to insert a gene of interest in plants.	
3.7	Propagate plants using cell cultures, callus culture, and algae culture.	
3.8	Research uses of cryopreservation in seed and in-vitro propagation methods.	
4.0	Demonstrate methods of plant production. The student will be able to:	

	4.1 Evaluate the advantages and disadvantages of non-traditional crop production techniques (hydroponic/substrate, greenhouse, tunnel/hoop, etc.).	
	4.2 Demonstrate different production methods used in hydroponics production.	
	4.3 Determine the cultural needs in hydroponics production.	
	4.4 Describe crops grown commercially by non-traditional techniques in your region.	
5.0	Use plants to demonstrate growth disorders (nutrients, pathogens, pests). The student will be able to:	
	5.1 Identify plant nutrient-related disorders.	
	5.2 Identify pathogen-related disorders in plants.	
	5.3 Identify pest-related disorders in plants.	
	5.4 Discuss how IPM and biotechnology are used to solve plant disorders.	
	5.5 Prepare plant tissue samples for submission to determine nutrient levels.	
	5.6 Demonstrate factors that affect the nutrient levels in plant tissue.	
6.0	Identify the historical, social, cultural and potential applications of plant biotechnology. The student will be able to:	
	6.1 Research and report on the major innovators and milestones in the development of biotechnology.	
	6.2 Analyze the scope and impact of plant biotechnology in today's global society.	
	6.3 Assess the future impact plant biotechnology could have on world populations.	
	6.4 Research, evaluate, and articulate a major regulatory issue pertaining to plant biotechnology.	
	6.5 Research, evaluate, and articulate the implications of an ethical, legal, social, or cultural biotechnology issue in plant production.	
	6.6 Research and debate an ethical issue associated with plant biotechnology.	
	6.7 Analyze an intellectual/genetic property issue associated with bioethics in plant production.	

Additional Information

Laboratory Activities

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

Florida Standards for English Language Development (ELD)

English language learners communicate for social and instructional purposes within the school setting. ELD.K12.ELL.SI.1

English Language Development (ELD) Standards Special Notes:
Teachers are required to provide listening, speaking, reading and writing instruction that allows English language learners (ELL) to communicate for social and instructional purposes within the school setting. For the given level of English language proficiency and with visual, graphic, or interactive support, students will interact with grade level words, expressions, sentences and discourse to process or produce language necessary for academic success. The ELD standard should specify a relevant content area concept or topic of study chosen by curriculum developers and teachers which maximizes an ELL's need for communication and social skills. For additional information on the development and implementation of the ELD standards, please contact the Bureau of Student Achievement through Language Acquisition at SALA@fldoe.org

Career and Technical Student Organization (CTSO)

Florida FFA is the co-curricular career and technical student organization providing leadership training and reinforcing specific career and technical skills. Career and Technical Student Organizations provide activities for students as an integral part of the instruction offered.

Cooperative Training – OJT

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

Accommodations

Federal and state legislation requires the provision of accommodations for students with disabilities as identified on the secondary student's Individual Educational Plan (IEP) or 504 plan or postsecondary student's accommodations' plan to meet individual needs and ensure equal access. Accommodations change the way the student is instructed. Students with disabilities may need accommodations in such areas as instructional methods and materials, assignments and assessments, time demands and schedules, learning environment, assistive technology and special communication systems. Documentation of the accommodations requested and provided should be maintained in a confidential file.

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

Some secondary students with disabilities (ESE) may need additional time (i.e., longer than the regular school year), to master the student performance standards associated with a regular course or a modified course. 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 a Career and Technical Education (CTE) course. The student should work on different competencies and new applications of competencies each year toward completion of the CTE course. 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.