FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT

Advanced Interdisciplinary Science for Sustainable Agriculture

Board Approval Date: May 20, 2021	**Course Length: 2 Semesters**
Grading: A-F	**Credits: 5 Credits per Semester**
Proposed Grade Level(s): 11, 12	**Subject Area: Elective** **Elective Area (if applicable):** **Career Technical Education**
Prerequisite(s): **Integrated Math 1, passing grade in Sustainable Agriculture Biology, Agriculture and Soil Chemistry or teacher approval.**	**Corequisite(s):** **N/A**
CTE Sector/Pathway: Agriculture & Natural Resources / Sustainable Agriculture	
Intent to Pursue 'A-G' College Prep Status: Yes	
A-G Course Identifier: (d) Laboratory Science	
Graduation Requirement: No	
Course Intent: Site Specific **Program (if applicable): CTE**	
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COURSE DESCRIPTION:

This integrated class combines an interdisciplinary approach to laboratory science and research with agricultural management principles. The course supports the Next Generation Science Standards (NGSS) including: HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, HS-ESS2-5, HS-ESS2-7, HS-LS1-4, HS-LS1-7, HS-LS2-1, HS-LS2-3, HS-LS2-4, HS-LS2-5, HS-LS2-7, HS-LS3-1, HS-LS3-2, HS-LS3-3, HS-LS4, HS-LS4-6, HS-ESS2-5, HS-ESS2-7, -6, HS-PS1-4, HS-PS1-6. Using skills and principles learned in the

course, students design systems and experiments to solve agricultural management issues currently facing the industry. Additionally, students will connect the products created in this class with industry activities to link real world encounters and implement skills demanded by both colleges and careers. The course culminates with an Agriscience experimental research project in which students design and conduct an experiment to solve a relevant issue. Final projects will be eligible for Career Development Event competition at FFA events. Throughout the course, students will be graded on participation in intracurricular FFA activities as well as the development and maintenance of an ongoing Supervised Agricultural Experience (SAE) program.

DETAILED UNITS OF INSTRUCTION:

Unit Number/Title	Unit Essential Questions	Examples of Formative Assessments	Examples of Summative Assessment
1. Research Methods in Agriscience	Why are science and research important to agriculture? Why is the scientific method necessary for research?	* Students begin the work of investigation into their project. * Students will read and deconstruct scholarly journal articles to identify the key components of Agriscience research.	*Students will create a journal project to demonstrate the research phase of their Agriscience project (Examples of student outcomes of the journal assignment could be: graphic organizer, abstract, oral presentation, visual aids, etc.)
2. Plant System	What are the risks and benefits of each method of pest control in regard to plant production, agricultural yields, and environmental sustainability? What effects do pests have on crop production? What are the chemical and biological principles that govern plant science and crop production?	* GMO's/Organic vs. Conventional Farming Debate and TED Talk (Students research scientific journal articles, laws, regulations, case studies or other scientific evidence that supports or refutes claims, then produce and submit a four to five minute TED talk to be reviewed by their peers.) * Categorizing Agriculture Pests (Students will categorize pests based on biological and physical characteristics.)	* Students will demonstrate the integration of pest management techniques by designing and conducting an experiment where they compare the four methods of pest management (biological, cultural, mechanical/physical, and chemical) on a specific pest and crop. Students will explain the effects of pest management techniques on biodiversity, ecosystem balance and agricultural

			productivity * Students will create a comprehensive crop production calendar for a specific crop, organic or conventional farming methods and a specific location. The calendar will include various cultural practices, time frames on pest controls and monitoring, analysis of neighboring field plantings, fertilization, post harvest procedure, soil amendments, days to re-entry, and harvest and land preparation
3. Animal Systems	How are animals affected by parasites and other infectious diseases? How do diseases and parasites impact livestock production in terms of growth efficiency and outcome of an animal?	* Facility Visits: Students will be taken to livestock production facilities to discover which type of facilities and feeding systems may have an impact on parasite infections. Students will then develop a written or live recommendation to the producer regarding the management protocols and handling needs to mitigate the parasites or pathogens found as a result of the experiments. * Survey – A formal research survey which will require students to contact a variety of local facilities, producers, and veterinarians. Students will engage in secondary research to investigate major livestock conditions, diseases, and parasites, with a focus on the inherent biological and chemical conditions that precede or enhance the condition. * Technical Reading and	* Lab Experiment 2 – Experimental Design Students will design and conduct a related experiment in which they investigate a parasite topic of their choice related to the final capstone project. A comparison of the effectiveness of various anthelmintics (dewormers) available to producers or commonly used on local production facilities. A statistical analysis may be conducted to help the student determine the likelihood that the results are due to the applied variable, rather than chance. Students will revisit the original hypothesis as they draw conclusions based upon the data. A discussion of limitations to the research

		Research – Students will analyze journal research and published studies and merge their survey data to create an infographic to be included in their final parasite management plan. * Lab Experiment 1 – Fecal Egg Counts-Practice Providing practical, Agriscience research skills, students will use the Modified McMaster's Fecal Egg Counting Protocol to perform a fecal egg count on livestock. A McMaster's fecal egg counting slide will allow students to quantify parasite infection through the egg counting and recording process. Students will produce a formal lab report and conclusion document.	and further studies will be included in a written report. * Parasite/Disease Management Plan for Livestock. Using their research, surveys, and information from their visits and interviews, students will create a parasite management plan. Students will present their portfolios to their peers and/or to local industry professionals at a formal symposium.
4. Natural Resources	What are natural resources and what purpose do they serve to the agriculture industry? What impacts do plant and animal systems have on natural resources? What is the importance of soil and water conservation, the effects of animals, erosion, pollution, and urban sprawl on watersheds, and human impact on the environment and natural resources?	* Water Quality: Students will locate and retrieve a sample of untreated water from local sources that have agricultural runoff. Water samples will be analyzed for the various particulates and contaminants. They will record pH, lead, nitrates, presence of pesticide residue, and coliform bacteria as well as sediment levels. Following their data collection and analysis, they will use problem solving skills to make recommendations for pollutant elimination. * Agriculture Practices, Natural Resource Conservation, and Case Studies. Students will be exposed to agencies that regulate the use of these	* Water Flow, Irrigation Plan, and Efficiency Model. Using the information and data collected in prior assignments, students will create a plan to analyze irrigation practices and efficiency in order to identify an appropriate irrigation system. Through the practice of building a water flow and efficiency model, students will identify innovative conservation approaches and irrigation methods such as scheduling irrigation rotations depending upon soil moisture, crop growing periods, availability of

		resources. Local directors of the United States Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), the Resource Conservation District (RCD), or any other pertinent industry professionals will present students with information about practical applications of water conservation, limiting pollutants, and practices that reduce environmental impacts of agriculture practices. Students will read and evaluate case studies of agriculture producing farms implementing sustainable practices. Case studies could include cover crops, owl boxes, crop rotation, and water runoff.	water, and methods of irrigation such as tape, drip, micro sprinklers, pressurized sprinklers, furrow, and flood. Sources of surface water and groundwater will be identified. Student irrigation plans will be based on a selected crop and data will be collected, analyzed, and interpreted, to form conclusions based on a multitude of variables.
5. Food Systems	How do chemical and biological principles impact end-stage agricultural practices in food safety and food preservation? What is the importance of implementing Hazardous Analysis Critical Control Point (HACCP) plans in the prevention of foodborne illness?	* Foodborne Disease and Its Role in Food Safety: Students will research a specific foodborne illness, and their findings in this research will be linked to laboratory investigations where they will determine the types of disease causing agents they collected on food samples and from the food preparation areas and tools. They will identify the type of disease causing agent (fungal, bacterial, viral, parasitic, noninfectious), transmission, treatment, and prevention in addition to reviewing production practices responsible for a specific outbreak of that disease. They will propose recommendations for prevention of future outbreaks	* Swabbing Hazards: After learning basic HACCP procedures, students will visit a commercial food production facility (school cafeteria, restaurant, processing site) and conduct a hazard analysis (as a basis for learning to investigate Principle 1 & 5 of a HACCP plan), swab samples of various surfaces (including but not limited to hands, door handles, tables, cutting surfaces, food preparation tools), and prepare and grow culture plates. After a period of growth, students will determine if potential

		and create and present a PowerPoint including their research findings. * Osmosis in Food Preparation: After learning appropriate food-handling protocols to reduce incidents of illness, students will engage in a series of chemistry-based exercises to learn the methods for preserving consumer food products safely. In particular this activity promotes student understanding of how jamming, dehydrating, and drying with salt or sugar are effective forms of food preservation, as they remove the water and change the chemical composition of food and delay the growth of microorganisms from harmful bacteria rendering the food safe for consumption. * Identifying Components to HACCP: Students will create a visual display that identifies the seven principles of a HACCP plan, which is a systematic approach to the identification, evaluation, and control of food safety hazards based on the following seven principles: Principle 1: Conduct a hazard analysis, Principle 2: Determine the critical control points (CCPs), Principle 3: Establish critical limits. Principle 4: Establish monitoring procedures, Principle 5: Establish corrective actions, Principle 6: Establish verification procedures, and Principle 7: Establish record-keeping and documentation procedures.	disease-causing agents are present, and if so, identify the specific pathogen. Students will record their findings in a written report. As a result students will determine the critical control points for that location (Principle 2 of the HACCP plan) based on the data generated from the swabs. Students will apply this skill in the development of their product and food safety plan. * Food Safety Product and Plan: The final project for the unit will ask student to develop a physical food product such as a fruit jam, dried vegetable product, oil, herb or seasoning mix, citrus juice, etc. and create a comprehensive food safety plan for the product that includes the HACCP and labeling standards. Students will choose a commodity from their growing region and utilizing food safety principles preserve it following scientifically proven preservation methods. Students will also engage in industry-standard testing protocols to assess the chemical profile of the food product (pH level, potential toxicity, etc.) as well as engage in a multi-interval microorganism testing

		Consequently, each of these principles will be researched and applied through experimentation throughout the unit, to create a comprehensive food safety plan for the food product students design for their final unit project.	protocol. Students will follow FDA guidelines and use prior unit knowledge to develop an appropriate label for their food that follows legal standards as well as agricultural marketing practices. They will prepare a written and three to five minute visual presentation (students will choose the media) for a panel of industry professionals.
6. Final Course Project	What are the elements of a written research project? How is scientific research, technical and scientific writing applied to a written research report? How is a professional visual display designed and presented?	Students will use all the culminated information collected throughout the course to create their final Agriscience project	*Agriscience Research Paper and Display: Throughout all units, students will gather knowledge through laboratory exercises to further develop and enhance their Agriscience Research programs. At the conclusion of the course, students will submit their research in a written paper, and it will include the following components: problem/purpose, background research, hypothesis, methodology, results/data, and discussion/ conclusion. The paper will be written using skills associated with technical and scientific writing, for example, refraining from the use of personal pronouns or keeping discussion limited to what the research and data suggest rather than

			personal opinion and bias. APA format will be utilized to reference and cite sources. Students will create a visual display board, using a digital format that mirrors the use of research posters in higher education, which will also include all the components of the paper, but in a condensed form. The peer group that reviewed the original experimental design will review the final research paper. The project and its findings will be shared with the class in an oral presentation, with the research board on display to aid in communicating the results of the research.

ESSENTIAL STANDARDS:

C2.1-5: Students understand the interrelationship between agriculture and the environment
C3.1-4: Students understand the effects of technology on agriculture
C6.1-2: Students understand animal anatomy and systems
C10.1-4: Students understand soil science principles
C11.1-6: Students understand plant growth and development
C12.1-3: Students understand fundamental pest management
C13.1-3: Students understand the scientific method

RELEVANT STANDARDS AND FRAMEWORKS, CONTENT/PROGRAM SPECIFIC STANDARDS:

Link to Common Core Standards (if applicable):
Educational standards describe what students should know and be able to do in each subject in each grade. In California, the State Board of Education decides on the standards for all students, from kindergarten through high school.
https://www.cde.ca.gov/be/st/ss/documents/finalelaccssstandards.pdf

Link to Framework (if applicable):
Curriculum frameworks provide guidance for implementing the content standards adopted by the State Board of Education (SBE). Frameworks are developed by the Instructional Quality Commission, formerly known as the Curriculum Development and Supplemental Materials Commission, which also reviews and recommends textbooks and other instructional materials to be adopted by the SBE.
https://www.nextgenscience.org/

Link to Subject Area Content Standards (if applicable):
Content standards were designed to encourage the highest achievement of every student, by defining the knowledge, concepts, and skills that students should acquire at each grade level.
https://www.cde.ca.gov/ci/ct/sf/documents/ctescrpflyer.pdf
https://www.cde.ca.gov/ci/ct/sf/documents/agnatural.pdf

Link to Program Content Area Standards (if applicable):
Program Content Area Standards applies to programs such as International Baccalaureate, Advanced Placement, Career and Technical Education, etc.
https://www.cde.ca.gov/ci/ct/sf/documents/agnatural.pdf

TEXTBOOKS AND RESOURCE MATERIALS:

Textbooks

Board Approved	Pilot Completion Date (If applicable)	Textbook Title	Author(s)	Publisher	Edition	Date
Yes		*Agriscience Fundamentals and Applications*	L. DeVere Burton	Cengage Learning	7th	*1/1/2015*
Yes		*Modern Livestock and Poultry*	Gillespie and Flanders	Cengage	8th	*1/1/2004*

Other Resource Materials

FFA Manual, National FFA Agriscience Fair Handbook, FDA HACCP, National Center for Home Canning, A Food Labeling Guide, California Public Health Department-Procedure for Obtaining a Canning License, Ball Canning, Centers for Disease Control-Food Safety/ Foodborne illness, Veterinary Medicines for Livestock, Food Allergens Guidance Documents & Regulatory, Environmental Protection Agency-Crop Production,

Supplemental Materials

Board approved supplemental materials (Including but not limited to: Film Clips, Digital Resources, Supplemental texts, DVDs, Programs (Pebble Creek, DBQ, etc.):
N/A