

Colorado AFNR Course Scope and Sequence

| Course Name | Greenhouse Production | | Course Details | Level 3 course in the Plant Science pathway. This would be the next level course in the Horticulture/Green Industry strand after Principles of Horticulture. | | |
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| | | | Course = 0.50 Carnegie Unit Credit | | | |
| Course Description | This advanced course offers instruction in greenhouse production. Units of study include plant identification, greenhouse management, integrated pest management, propagation, growing media, growing greenhouse crops, horticulture mechanics, Agribusiness units will cover operating a horticultural business, pricing work, advertising, and sales. Participation in FFA student organization activities and Supervised Agricultural Experience (SAE) projects is an integral course component for leadership development, career exploration and reinforcement of academic concepts. | | | | | |
| Note: | This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered. | | | | | |
| SCED Identification # | Schedule calculation based on 60% of a semester instructional time. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics. | | | | | |
| All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at https://www.cde.state.co.us/standardsandinstruction/essentialskills | | | | | | |
| Unit Number, Title and Brief Description | Suggested % of Instructional Time | CTE or Academic Standard Alignment | Competency / Performance Indicator | Outcome / Measurement | CTSO Integration | |
| Unit 1: Careers and Industry | 2% | CS.05. Describe career opportunities and means to achieve those opportunities in each of the Agriculture, Food & Natural Resources career pathways. | CS.05.02. Examine and choose career opportunities that are matched to personal skills, talents, and career goals in an AFNR pathway of interest. | CS.05.02.01.a. Examine and categorize careers in Greenhouse Production | | |
| Unit 2: Structures and Equipment <ul style="list-style-type: none"> Types of Greenhouse designs Greenhouse structural materials and applications (Superstructures, glazing, floors & walkways, benches) | 12% | PST.04. Plan, build and maintain AFNR structures. | PST.04.02. Determine structural requirements, specifications and estimate costs for AFNR structures | PST.04.01.02.c. Evaluate, plan and design functional and efficient facilities for use in AFNR power, structural and technical systems. PST.04.02.02.b. Assess and analyze local building | Land Evaluation CDE | |

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| <ul style="list-style-type: none"> • Environmental Control (Heating, cooling, ventilation) • Water Systems (hose, drip, spray/mist) | | <p>PST.05 Use control, monitoring, geospatial, and other technologies in AFNR power, structural, and technical systems.</p> | <p>PS.04.03 Follow architectural and mechanical plans to construct, maintain and/or repair AFNR structures (e.g. materials, selection, site preparation, and/or layout, plumbing, concrete/masonries, etc)</p> <p>PST.05.01 Apply computer and other technologies (e.g. robotics, CNC, UAS, etc) to solve problems and increase efficiency of AFNR systems. <i>SCIENCE: SC.HS.3.9</i> <i>NGSS.HS.ETS1.3</i></p> <p>PST.05.02 Prepare and/or use electrical drawings to design, install, and troubleshoot electronic control systems in AFNR settings</p> <p>PST.05.03 Apply geospatial technologies to solve problems and increase the efficiency of AFNR systems. <i>SCIENCE: SC.HS.3.9</i> <i>SC.HS.3.11</i> <i>NGSS.HS.ETS1.3</i></p> | <p>code requirements for agriculture structures.</p> <p>PS.04.03.07.a Differentiate between types of insulation materials used in AFNR structures.</p> <p>PST.05.01.02.a Examine and summarize the specific intent of technologies used to solve problems and increase the efficiency of AFNR systems (e.g. robotics, UAS, CNC, etc)</p> <p>PST.05.02.03.a Research and summarize the importance of AFNR power, structural and technical control systems using programmable logic controllers (PLC) and/or other computer-based systems.</p> <p>PST.05.03.02.c Solve problems and evaluate changes in efficiency and create recommendations for the use of technologies in AFNR systems.</p> | |
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| <p>Unit 3: Containers, Media, Greenhouse Crops</p> <ul style="list-style-type: none"> • Types of Greenhouse Crops • Growing containers (ground beds, bench beds, containers) • Growing media (components, applications, advantages and disadvantages) | 6% | <p>PS.01. Develop and implement a crop management plan for a given production goal that accounts for environmental factors.</p> <p>PS.03. Propagate, culture and harvest plants and plant products based on current industry standards.</p> | <p>PS.01.02. Prepare and manage growing media for use in plant systems.</p> <p>PS.03.02. Develop and implement a management plan for plant production. ELA: RW.HS.1.2.2 RST.9-10.3 WHST.9-10.2 WHST.9-10.4 WHST.9-10.9</p> <p>PS.03.04. Apply principles and practices of sustainable agriculture to plant production SCIENCE: SC.HS.3.9</p> | <p>PS.01.02.01.b Describe the physical and chemical characteristics of growing media and explain the influence they have on plant growth.</p> <p>PS.01.02.01.c. Formulate and prepare growing media for specific plants or crops.</p> <p>PS.03.02.02.a. List and summarize the reasons for preparing growing media before planting.</p> <p>PS.03.04.01.c. Research, prepare and defend plans for a plant systems enterprise that aligns with USDA sustainable practices criteria.</p> | |
| <p>Unit 4: Nutrients</p> <ul style="list-style-type: none"> • Nutritional requirements (growing stage of crops) • Feeding programs (continuous vs. intermittent) • Fertilizer, forms, & types • Application methods (slow release, fertigation, foliar spray) | 4% | <p>PS.01. Develop and implement a crop management plan for a given production goal that accounts for environmental factors.</p> | <p>PS.01.03. Develop and implement a fertilization plan for specific plants or crops. MATH: MA.HS.N.Q.A</p> | <p>PS.01.03.01.c. Monitor plants for signs of nutrient deficiencies and prepare a scouting report to correct elements negatively affecting plant growth in a field or greenhouse.</p> <p>PS.01.03.02.a. Discuss the influence of pH and cation exchange capacity on the availability of nutrients.</p> | |

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| | | | | <p>PS.01.03.04.a. Identify fertilizer sources of essential plant nutrients; explain fertilizer formulations, including organic and inorganic; and describe different methods of fertilizer application.</p> | |
| <p>Unit 5: Propagation</p> <ul style="list-style-type: none"> • Propagation methods • Propagation Production processes (equipment, growing management) | 12% | <p>PS.03. Propagate, culture and harvest plants and plant products based on current industry standards.</p> | <p>PS.03.02. Develop and implement a management plan for plant production. ELA: HS.1.2.2</p> | <p>PS.03.02.04.c. Prepare and implement a plant production schedule based on predicted environmental conditions and desired market target (e.g., having plants ready to market on a specific day such as Mother's Day, organic production, low maintenance landscape plants, etc.).</p> <p>PS.03.02.05.c. Prepare plant production schedules utilizing plant growth knowledge to get plants to their optimal growth stage at a given time.</p> <p>PS.03.02.06.c. Research, select and defend technology for use in controlled atmosphere production.</p> | |
| <p>Unit 6: Growth Factors</p> <ul style="list-style-type: none"> • Control of growth factors to manage crop timing (temperature, CO2 enrichment, hardening, photoperiod control, PGRs) | 15% | <p>PS.01. Develop and implement a crop management plan for a given production goal that accounts for environmental factors.</p> | <p>PS.01.01. Determine the influence of environmental factors on plant growth. SCIENCE: SC.HS.2.6</p> | <p>PS.01.01.01.c. Analyze plant responses to varied light color, intensity and duration and recommend modifications to light for desired plant growth.</p> <p>PS.01.01.02.c. Design, implement and evaluate a</p> | |

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| | | | | <p>plan to maintain optimal air and temperature conditions for plant growth.</p> <p>PS.01.01.03.c. Analyze plant responses to water conditions and recommend modifications to water for desired plant growth.</p> | |
| <p>Unit 7: Integrated Pest Management</p> <ul style="list-style-type: none"> • Common pest identification • Pest scouting • Pest control techniques | 5% | <p>PS.03. Propagate, culture and harvest plants and plant products based on current industry standards.</p> | <p>PS.03.02. Develop and implement a management plan for plant production. <i>ELA: RW.HS1.2.2</i></p> <p>PS.03.03. Develop and implement a plan for integrated pest management for plant production</p> | <p>PS.03.02.01.c. Produce pest- and disease-free propagation material.</p> <p>PS.03.03.01.c. Devise solutions for plant pests, diseases and disorders.</p> <p>.03.03.02.c. Design and implement a crop scouting program.</p> <p>PS.03.03.03.c. Employ pest management strategies to manage pest populations, assess the effectiveness of the plan and adjust the plan as needed.</p> <p>PS.03.03.04.b. Examine and apply procedures for the safe handling, use and storage of pesticides including personal protective equipment and reentry interval.</p> | |
| <p>Unit 8: Aquaponics/Hydroponics</p> <ul style="list-style-type: none"> • System requirements | 2% | <p>PS.03. Propagate, culture and harvest plants and plant</p> | <p>PS.03.02. Develop and implement a</p> | <p>PS.03.02.06.c. Research, select and defend technology for use in</p> | |

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| <ul style="list-style-type: none"> System designs (NFT, aero, water bed, ebb & flow) | | <p>products based on current industry standards.</p> | <p>management plan for plant production.</p> | <p>controlled atmosphere production.</p> <p>PS.03.02.07.c. Research, select and defend the use of a hydroponic or aquaponic plant system.</p> | |
| <p>Unit 9: Marketing & Business</p> | <p>2%</p> | <p>ABS.03. Manage cash budgets, credit budgets and credit for an AFNR business using generally accepted accounting principles</p> <p>ABS.05. Use sales and marketing principles to accomplish AFNR business objectives. .</p> | <p>ABS.03.01. Performance Indicator: Develop, assess and manage cash budgets to achieve AFNR business goals.</p> <p>ABS.05.01. Analyze the role of markets, trade, competition and price in relation to an AFNR business sales and marketing plans.</p> | <p>ABS.03.01.01.a. Compare and contrast components of cash budgets (e.g., anticipated revenue, production costs, overhead costs, profit, etc.) and identify the appropriate components to include in a budget given the nature of the AFNR enterprise.</p> <p>ABS.03.01.02.a. Research and summarize factors that impact management of cash budgets in AFNR businesses (e.g., changes in price of inputs/outputs, financial investment performance, capital purchases, human resources, etc.).</p> <p>ABS. 05.01.02.a. Research and summarize different forms of market competition found in AFNR businesses (e.g., direct competitors, indirect competitors, replacement competitors, etc).</p> <p>ABS.05.01.02.b. Compare and contrast different forms of market</p> | |

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| | | | <p>ABS.05.03. Assess marketing principles and develop marketing plans to accomplish AFNR business objectives.</p> <p><i>ELA: RW.HS1.2.3</i> <i>RW.HS2.2.3</i> <i>RW.HS1.3.2</i> <i>RW.HS2.3.2</i> <i>RW.HS1.1.2</i> <i>RW.HS2.1.2</i></p> | <p>competition and how they can be applied to different AFNR businesses.</p> <p>ABS.05.03.01.a. Identify and explain marketing principles used in AFNR businesses (e.g., 4 P's- product, place, price, promotion; attention, interest, desire, action, etc.).</p> <p>ABS.05.03.02.a. Research and categorize different strategies used in marketing programs for AFNR businesses (e.g., Internet, direct to customer, social media, etc.).</p> <p>ABS.05.03.03.b. Perform a market analysis to gather information for marketing plans for AFNR businesses (e.g., evaluation of competitors, customers, domestic and international policy, regulations and rules, standards, etc.).</p> | |
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CAS Academic Standards Alignment: Online Version: <https://www.cde.state.co.us/apps/standards/>; Download version: <https://www.cde.state.co.us/apps/standards/>

Reading, Writing, and Communicating: (RST/WHST are Common Core Standards aligned; <http://www.corestandards.org/ELA-Literacy/RI/introduction-for-6-12/>)

- RW.HS1.1.2 – Organize and develop credible presentations tailored to purpose and audience.
- RW.HS2.1.2 – Integrate credible, accurate information into appropriate media and formats to meet an audience's needs.
- RW.HS1.2.2 – Understand the logical progression of ideas in increasingly complex texts

- RW.HS1.2.3 – Utilize context, parts of speech, grammar, and word choice to understand narrative, argumentative, and informational texts.
- RW.HS2.2.3 – Understand how language influences comprehension of narratives, argumentative, and informational texts.
- RW.HS1.3.2 – Write informative/explanatory texts using complex ideas and organizational structures and features that are useful to audience comprehension.
- RW.HS2.3.2 – Write informational/explanatory texts to examine and convey complex ideas through the effective selection, organization, and analysis of content.
- RST.9-10.3 – 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.
- RST.9-10.4 – 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 9-10 texts and topics*.
- RST.9-10.2a - Introduce a topic and organize ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
- WHST.9-10.2 – Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.9-10.4 - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.9-10.9 - Draw evidence from informational texts to support analysis, reflection, and research.

Math:

- MA.HS.N-Q.A – Quantities: Reason quantitatively and use units to solve problems.

Science:

- SC.HS.2.6 – A complex set of interactions determine how ecosystems respond to disturbances.
- SC.HS.3.9 – Resources availability has guided the development of human society and use of natural resources has associated costs, risks, and benefits.
- SC.HS.3.11 -Sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources, including the development of technology
- NGSS.ETS.HS.1.3 – Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts.

Essential Skills:

Problem Solver:

- **Critical Thinking and Analysis:** The ability to apply a deliberate process of identifying problems, gathering information, and weighing possible solutions, including: making choices rooted in understanding patterns, cause-and-effect relationships, and the impacts that a decision can have on the individual and others.

Community Member:

- **Civic Engagement:** The ability to develop and apply knowledge, skills, and habits gained from experiences – within communities of diverse perspectives – to address issues, affect change, and/or solve problems.

Empowered Individual:

- **Self-Management:** The ability to manage one's emotions, thoughts and behaviors effectively in different situation and to achieve goals and aspirations, including: the capacity to delay gratification, manage stress, stay productive and accountable, and feel motivation & agency to accomplish personal/collective goals.
- **Career Awareness:** The ability to apply the knowledge and understanding of how one's dreams, experiences, and interests translate into career fulfillment and lifelong pursuits in local, regional, national, and global career pathways and opportunities.