Chapter 130. Texas Essential Knowledge and Skills for Career and Technical Education

Subchapter A. Agriculture, Food, and Natural Resources

§130.1. Implementation of Texas Essential Knowledge and Skills for Agriculture, Food, and Natural Resources, Adopted 2015.

(a) The provisions of this subchapter shall be implemented by school districts beginning with the 2018-2019 school year.

(b) No later than August 31, 2017, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for career and technical education as adopted in §§130.2-130.31 of this subchapter.

(c) If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §§130.2-130.31 of this subchapter shall be implemented beginning with the 2018-2019 school year and apply to the 2018-2019 and subsequent school years.

(d) If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than August 31 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §§130.2-130.31 of this subchapter shall be implemented for the following school year.

§130.2. Principles of Agriculture, Food, and Natural Resources (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Principles of Agriculture, Food, and Natural Resources will allow students to develop knowledge and skills regarding career and educational opportunities, personal development, globalization, industry standards, details, practices, and expectations. To prepare for careers in agriculture, food, and natural resources, students must attain academic skills and knowledge in agriculture. To prepare for success, students need opportunities to learn, reinforce, experience, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the field of agriculture, food, and natural resources;

(B) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in agriculture, food, and natural resources;

(C) demonstrate knowledge of personal and occupational safety, environmental regulations, and first-aid policy in the workplace;

(D) analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and

(E) identify careers in agriculture, food, and natural resources with required aptitudes in science, technology, engineering, mathematics, language arts, and social studies.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student analyzes concepts related to global diversity. The student is expected to:

(A) compare and contrast global agricultural markets, currency, and trends; and

(B) evaluate marketing factors and practices that impact the global markets.

(4) The student explains the historical, current, and future significance of the agriculture, food, and natural resources industry. The student is expected to:

(A) define the scope of agriculture;

(B) analyze the scope of agriculture, food, and natural resources and its effect upon society;

(C) evaluate significant historical and current agriculture, food, and natural resources developments;

(D) identify potential future scenarios for agriculture, food, and natural resources systems, including global impacts;

(E) describe how emerging technologies and globalization impacts agriculture, food, and natural resources; and

(F) compare and contrast issues impacting agriculture, food, and natural resources such as biotechnology, employment, safety, environment, and animal welfare issues.

(5) The student analyzes the structure of agriculture, food, and natural resources leadership in organizations. The student is expected to:

(A) develop and demonstrate leadership skills and collaborate with others to accomplish organizational goals and objectives;

(B) develop and demonstrate personal growth skills and collaborate with others to accomplish organizational goals and objectives; and

(C) demonstrate democratic principles in conducting effective meetings.

(6) The student demonstrates appropriate personal and communication skills. The student is expected to:

(A) demonstrate written and oral communication skills appropriate for formal and informal situations such as prepared and extemporaneous presentations; and

(B) demonstrate effective listening skills appropriate for formal and informal situations.

(7) The student applies appropriate research methods to agriculture, food, and natural resources topics. The student is expected to:

(A) discuss major research and developments in the fields of agriculture, food, and natural resources;

(B) use a variety of resources for research and development; and

(C) describe scientific methods of research.

(8) The student applies problem-solving, mathematical, and organizational skills in order to maintain financial and logistical records. The student is expected to:

(A) develop a formal business plan; and

(B) develop, maintain, and analyze records.

(9) The student uses information technology tools to access, manage, integrate, and create information related to agriculture, food, and natural resources. The student is expected to:

(A) apply technology applications such as industry-relevant software and Internet applications;

(B) use collaborative, groupware, and virtual meeting software;

(C) analyze the benefits and limitations of emerging technology such as online mapping systems, drones, and robotics; and

(D) explain the benefits of computer-based and mobile application equipment in agriculture, food, and natural resources.

(10) The student develops technical knowledge and skills related to soil systems. The student is expected to:

(A) identify the components and properties of soils;

(B) identify and describe the process of soil formation; and

(C) conduct experiments related to soil chemistry.

(11) The student develops technical knowledge and skills related to plant systems. The student is expected to:

(A) describe the structure and functions of plant parts;

(B) discuss and apply plant germination, growth, and development;

(C) describe plant reproduction, genetics, and breeding;

(D) identify plants of importance to agriculture, food, and natural resources; and

(E) use tools, equipment, and personal protective equipment common to plant systems.

(12) The student develops technical knowledge and skills related to animal systems. The student is expected to:

(A) describe animal growth and development;

(B) identify animal anatomy and physiology;

(C) identify and evaluate breeds and classes of livestock; and

(D) explain animal selection, reproduction, breeding, and genetics.

(13) The student describes the principles of food products and processing systems. The student is expected to:

(A) evaluate food products and processing systems;

(B) determine trends in world food production;

(C) discuss current issues in food production; and

(D) use tools, equipment, and personal protective equipment common to food products and processing systems.

(14) The student safely performs basic power, structural, and technical system skills in agricultural applications. The student is expected to:

(A) identify major areas of power, structural, and technical systems;

(B) use safe and appropriate laboratory procedures and policies;

(C) create proposals that include bill of materials, budget, schedule, drawings, and technical skills developed for basic power, structural, and technical system projects or structures;

(D) identify building materials and fasteners; and

(E) use tools, equipment, and personal protective equipment common to power, structural, and technical systems.

(15) The student explains the relationship between agriculture, food, and natural resources and the environment. The student is expected to:

(A) determine the effects of agriculture, food, and natural resources upon safety, health, and the environment;

(B) identify regulations relating to safety, health, and environmental systems in agriculture, food, and natural resources;

(C) identify and design methods to maintain and improve safety, health, and environmental systems in agriculture, food, and natural resources;

(D) research and analyze alternative energy sources that stem from or impact agriculture, food, and natural resources; and

(E) evaluate energy and water conservation methods.

§130.3. Professional Standards in Agribusiness (One-Half Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one-half credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Professional Standards in Agribusiness primarily focuses on leadership, communication, employer-employee relations, and problem solving as they relate to agribusiness. To prepare for careers in agribusiness systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to leadership development and the workplace, and develop knowledge and skills regarding agricultural career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career and entrepreneurship opportunities related to agribusiness;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in agriculture, food, and natural resources industries;

(C) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(D) demonstrate employers' expectations and appropriate work habits;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student demonstrates professional development related to effective leadership in agribusiness. The student is expected to:

(A) describe the importance of positive self-concept, social skills, and maintaining a professional image with respect to cultural diversity;

(B) identify leadership styles;

(C) prepare personal resumes, letters of interest, and employment applications; and

(D) use positive interpersonal skills to work cooperatively with others from different cultures, genders, and backgrounds.

(4) The student evaluates employer and employee responsibilities for occupations in agriculture, food, and natural resources. The student is expected to:

(A) identify and discuss work-related and agribusiness-related ethics;

(B) demonstrate methods for working effectively with others;

(C) practice job interview and evaluation skills; and

(D) outline complaint and appeal processes.

(5) The student communicates effectively with groups and individuals. The student is expected to:

(A) understand elements of communication such as accuracy, relevance, rhetoric, and organization in informal, group discussions; formal presentations; and business-related, technical communication;

(B) describe how the style and content of spoken language varies in different contexts and influences the listener's understanding;

(C) modify aspects of presentations such as delivery, vocabulary, length, and purpose;

(D) identify appropriate written and verbal communications in agribusiness;

(E) demonstrate effective listening in a variety of settings;

(F) demonstrate nonverbal communication skills and effective listening strategies; and

(G) discuss the importance of relationships and group organization.

(6) The student identifies professional agricultural communications using appropriate spoken communication techniques and procedures. The student is expected to:

(A) identify the importance of verbal and nonverbal communication;

(B) demonstrate the importance of communicating factual and unbiased data and information obtained from reliable sources;

(C) demonstrate speech preparation and delivery skills such as using presentation software and technology etiquette; and

(D) plan and deliver focused and coherent presentations that convey clear and distinct perspectives and demonstrate solid reasoning.

(7) The student demonstrates the factors of group and individual efficiency. The student is expected to:

(A) define the significance of personal and group goals;

(B) demonstrate leadership traits when solving a problem such as risk-taking, focusing on results, decision making, and empowering and investing in individuals when leading a group;

(C) discuss the importance of time management and teamwork;

(D) list the steps in the decision-making and problem-solving processes; and

(E) demonstrate a working knowledge of parliamentary law.

(8) The student identifies opportunities for involvement in agribusiness professional organizations. The student is expected to:

(A) discuss the role of agricultural organizations in formulating public policy;

(B) develop strategies for effective participation in agricultural organizations; and

(C) identify and discuss the purpose of various agricultural organizations such as the Texas Farm Bureau, Association of Soil and Water Conservation Districts, Texas and Southwestern Cattle Raisers Association, and Independent Cattlemen's Association and agricultural cooperatives, commodity associations, and breed associations.

(9) The student identifies and researches current agribusiness issues. The student is expected to:

(A) compare and contrast the marketing of agricultural and non-agricultural products; and

(B) describe the effects of urbanization on traditional agriculture.

§130.4. Agribusiness Management and Marketing (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and

resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Agribusiness Management and Marketing is designed to provide a foundation to agribusiness management and the free enterprise system. Instruction includes the use of economic principles such as supply and demand, budgeting, record keeping, finance, risk management, business law, marketing, and careers in agribusiness. To prepare for careers in agribusiness systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to agribusiness marketing and management and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in agribusiness systems;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in agribusiness systems;

(C) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student recognizes roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment. The student is expected to:

(A) identify how key organizational systems affect organizational performance and the quality of products and services related to agriculture, food, and natural resources;

(B) demonstrate an understanding of the global context of agricultural industries and careers; and

(C) describe the nature and types of agribusiness organizations to build an understanding of the scope of organizations.

(4) The student examines critical aspects of career opportunities in one or more agriculture, food, and natural resources careers. The student is expected to:

(A) research and interpret information for one or more careers in agriculture, food, or natural resources; and

(B) identify educational and credentialing requirements for one or more careers in agriculture, food, and natural resources.

(5) The student defines and examines agribusiness management and marketing and its importance to the local and international economy. The student is expected to:

(A) describe the roles and functions of management and leadership in agribusiness;

(B) identify key economic principles of free enterprise; and

(C) analyze the economic opportunities of agribusiness.

(6) The student defines the importance of maintaining records and budgeting in agribusiness. The student is expected to:

(A) maintain appropriate agribusiness records such as payroll, employee benefits, journals, inventories, income and expense logs, financial statements, and balance sheets;

(B) identify methods of obtaining agribusiness loans and financing; and

(C) compare methods of capital resource acquisition as it pertains to agriculture.

(7) The student describes issues related to government policy and recognizes concepts related to cultural diversity. The student is expected to:

(A) analyze methods of decision making;

(B) examine the effects of government policies and regulations in making management decisions;

(C) describe the management of human resources with respect to cultural diversity;

(D) identify laws pertaining to land and property ownership and uses, taxes, wills, and liabilities; and

(E) develop a personal economic philosophy.

(8) The student defines key issues of agribusiness success and failure. The student is expected to:

(A) apply the decision-making process for budgeting issues;

(B) analyze business records and record-keeping procedures;

(C) determine methods of financing agribusiness;

(D) identify methods of obtaining capital resources; and

(E) analyze agricultural commodity markets.

(9) The student describes the marketing of agricultural products. The student is expected to:

(A) describe the purpose and importance of marketing;

(B) develop a marketing plan;

(C) identify the competitive environment and the impact of foreign markets;

(D) compare types of markets and influence factors; and

(E) identify methods of managing risk such as hedging and crop insurance.

(10) The student knows the efficiency aspects of agribusiness management. The student is expected to:

(A) use management software and information technology such as spreadsheets and databases;

(B) develop an entrepreneurial plan based on personal economic philosophy;

(C) develop a financial management plan; and

(D) present a business proposal.

§130.5. Mathematical Applications in Agriculture, Food, and Natural Resources (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: Algebra I and one credit from the courses in the Agriculture, Food, and Natural Resources Career Cluster. This course satisfies a high school mathematics graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Mathematical Applications in Agriculture, Food, and Natural Resources, students will apply knowledge and skills related to mathematics, including algebra, geometry, and data analysis in the context of agriculture, food, and natural resources. To prepare for careers in agriculture, food, and natural resources, students must acquire technical knowledge in the discipline as well as apply academic skills in mathematics. To prepare for success, students need opportunities to reinforce, apply, and transfer their knowledge and skills related to mathematics in a variety of contexts.

(4) The mathematical process standards describe ways in which students are expected to engage in the content. The placement of the process standards at the beginning of the knowledge and skills listed for each grade and course is intentional. The process standards weave the other knowledge and skills together so that students may be successful problem solvers and use mathematics efficiently and effectively in daily life. The process standards are integrated at every grade level and course. When possible, students will apply mathematics to problems arising in everyday life, society, and the workplace. Students will use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution. Students will select appropriate tools such as real objects, manipulatives, paper and pencil, and technology and techniques such as mental math, estimation, and number sense to solve problems. Students will effectively communicate mathematical ideas, reasoning, and their implications using multiple representations such as symbols, diagrams, graphs, and language. Students will use mathematical relationships to generate solutions and make connections and predictions. Students will analyze mathematical relationships to connect and communicate mathematical ideas. Students will display, explain, or justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(5) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(6) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities;

(B) demonstrate competencies related to resources, information, interpersonal skills, and systems of operation;

(C) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

(A) apply mathematics to problems arising in everyday life, society, and the workplace;

(B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;

(C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;

(D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;

(E) create and use representations to organize, record, and communicate mathematical ideas;

(F) analyze mathematical relationships to connect and communicate mathematical ideas; and

(G) display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

(3) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(4) The student performs mathematical calculations used in agriculture, food, and natural resources. The student is expected to:

(A) add, subtract, multiply, and divide whole numbers, fractions, and decimals in calculations related to agriculture, food, and natural resources;

(B) apply mathematical skills such as measurement, conversion, and data analysis needed for agriculture, food, and natural resources;

(C) find solutions to problems related to agriculture, food, and natural resources by calculating percentages and averages;

(D) convert between English and metric units;

(E) use scientific calculations to determine weight, volume, and linear measurements;

(F) solve word problems using ratios and dimensional analysis; and

(G) interpret data using tables, charts, and graphs.

(5) The student demonstrates mathematics knowledge and skills required to solve problems related to the agriculture, food, and natural resources industries. The student is expected to:

(A) demonstrate use of relational expressions such as equal to, not equal, greater than, and less than in agriculture, food, and natural resources industries such as agribusiness; animal; environmental service; food products and processing; natural resources; plant; and power, structural, and technical systems;

(B) apply statistical and data analysis to solve problems related to agriculture, food, and natural resources industries such as agribusiness; animal; environmental service; food products and processing; natural resources; plant; and power, structural, and technical systems;

(C) analyze mathematical problem statements for missing or irrelevant data essential to agriculture, food, and natural resources industries such as agribusiness; animal; environmental service; food products and processing; natural resources; plant; and power, structural, and technical systems;

(D) construct and analyze charts, tables, and graphs from functions and data generated in agriculture, food, and natural resources industries such as agribusiness; animal; environmental service; food products and processing; natural resources; plant; and power, structural, and technical systems;

(E) analyze data using measures of central tendency when interpreting operational documents in agriculture, food, and natural resources industries such as agribusiness; animal; environmental service; food products and processing; natural resources; plant; and power, structural, and technical systems; and

(F) use mathematical operations and knowledge of relationships to solve problems such as the calculation of gallons of water from inches of rain, acres of ground water, liquid and gaseous volumes, and conversion of units; calculation of caloric value, parts per million of restricted ingredients, conversion of measurements, and U.S. Department of Agriculture (USDA) grades; estimation of wildlife populations and pulpwood yields; and calculation of mapping data inherent to systems of agriculture or agribusiness.

(6) The student demonstrates mathematical knowledge and skills required to solve problems related to agribusiness systems and related career opportunities. The student is expected to:

(A) use mathematical operations and knowledge of relationships to solve daily problems related to record keeping such as profit/loss statements, income statements, capital asset inventories, insurance, risk management, lease agreements, employee payroll and benefits, and investments and loan, real estate contract, or tax documentation in agribusiness systems;

(B) demonstrate knowledge of algebraic applications and linear and exponential functions related to concepts such as simple interest, compound interest, maturity value, tax rates, depreciation, production analysis, market trends, investments, and price determination in agribusiness systems;

(C) use statistical and data analysis, including counts, percentages, central tendency, and prediction, to evaluate agribusiness systems data such as demographic, production, consumption, weather, and market data; and

(D) report statistical data related to concepts such as pricing, market trends, commodity prices, exports and imports, supply and demand, and production yields numerically or graphically.

(7) The student demonstrates mathematical knowledge and skills required to solve problems related to animal systems and related career opportunities. The student is expected to:

(A) use mathematical operations and knowledge of relationships to solve problems such as the calculation of purchasing, marketing, and production costs; housing requirements; conversion of units; average daily gain; topical and injectable medication dosages; USDA grades; feeding schedules; volumes; stocking rates; and breeding and gestation cycles related to animal systems;

(B) demonstrate knowledge of algebraic applications related to animal system calculations such as ration formulation using the Pearson Square, percent homozygosity, heritability, USDA grades, gene frequency, cost per unit of nutrient, and weaning weight ratio;

(C) use geometric principles to solve problems such as the use of right triangles for perpendicular cross fencing and the calculation of square footage for housing requirements; acreage for normal and irregular shaped pastures; feed bin volume based upon shape such as cylinder, cone, cube, or pyramid; and housing volume for ventilation related to animal systems; and

(D) use statistical and data analysis to evaluate animal systems data reported numerically or graphically such as birth weight, weaning weight, days to market weight, expected progeny differences, feed efficiencies, birth type, litter size, presence or absence of genetic abnormality, milk production, sow productivity index, and veterinary costs or records.

(8) The student demonstrates mathematical knowledge and skills required to solve problems related to environmental service systems and related career opportunities. The student is expected to:

(A) demonstrate knowledge of algebraic applications to create solutions to problems such as the calculation of acre feet of water, water volume in ponds, water well volume, water pressure friction loss, flow rate, total head pressure, pump efficiency, soil solids volume, and soil degree of saturation related to environmental service systems;

(B) use geometric principles to solve problems such as calculating acreage for normal and irregular shaped pastures and slope of land, planning runoff drainage structures, and applying differential leveling techniques related to environmental service systems; and

(C) use statistical and data analysis to evaluate environmental service systems data reported numerically or graphically such as rainfall, soil classifications, groundwater levels, recycling activities, and pollution rates.

(9) The student demonstrates mathematical knowledge and skills required to solve problems related to food products and processing systems and related career opportunities. The student is expected to:

(A) demonstrate knowledge of algebraic applications to solve problems such as the calculation of exponential growth of bacteria, contribution margin in processing, percentage of weight loss in packaged food, percentage of water absorption in packaged food, and microbe analysis following pasteurization related to food products and processing systems;

(B) use geometric principles to solve problems such as the calculation of packaging requirements, construction of food storage structures and containers, liquid transfer materials, and vessels design and volume related to food products and processing systems; and

(C) use statistical and data analysis to evaluate food products and processing systems data reported numerically or graphically such as governmental regulations, hazard analysis, critical control points data, taste tests, quality assurance data, and industry packing practices.

(10) The student demonstrates mathematical knowledge and skills required to solve problems related to natural resource systems and related career opportunities. The student is expected to:

(A) demonstrate knowledge of algebraic applications to solve problems such as the calculation of mean harvest area, calibration of pesticides, and the Doyle Log Rule related to natural resource systems;

(B) use geometric principles to solve problems such as planning and construction of structures related to wildlife and fisheries management, determination of lumber volume in given tree stock, and calculation of tank volume for chemical application related to natural resource systems; and

(C) use statistical and data analysis to evaluate natural resource systems data reported numerically or graphically such as Geographic Information Systems and Global Positioning Systems data, weather-related data, and data related to wildlife and habitat.

(11) The student demonstrates mathematical knowledge and skills required to solve problems related to plant systems and related career opportunities. The student is expected to:

(A) use mathematical operations and knowledge of relationships to solve problems such as the calculation of crop yields, crop loss, grain drying requirements, grain weight shrinkage, germination rates, greenhouse heating, and cooling and fertilizer application rates related to plant systems;

(B) demonstrate knowledge of algebraic applications to solve problems such as the calculation of grain handling efficiency, harvesting capacity, crop rotation, seeding rates, fertilizer nutrient requirements, and greenhouse ventilation related to plant systems;

(C) use geometric principles for the analysis of problems such as planning grain storage structures and calculating volume of grain storage vessels, grain handling volume, greenhouse capacity, and regular and irregular shaped planting bed size related to plant systems; and

(D) use statistical and data analysis to evaluate plant systems data such as crop yields, Global Information Systems data, plant growth data, and climate data.

(12) The student demonstrates mathematical knowledge and skills required to solve problems related to power, structural, and technical systems and related career opportunities. The student is expected to:

(A) use mathematical operations and knowledge of relationships to solve problems such as the calculation of gear ratio, fuel efficiency, construction costs, project layout, energy costs, unit conversions, and bid preparation and labor-related calculations related to power, structural, and technical systems;

(B) demonstrate knowledge of algebraic applications such as the calculation of strength of magnetism, chain or belt tension, horsepower, Ohm's Law, hydraulic multiplication of force, stresses using Mohr's Circle, and tensile strength related to power, structural, and technical systems;

(C) use geometric principles for the evaluation of problems such as rafter length, land measurement, differential leveling, concrete volume, heating, ventilating, and air conditioning requirements and creation of structural drawings related to power, structural, and technical systems;

(D) use statistical and data analysis to evaluate power, structural, and technical systems data such as construction cost data; equipment maintenance; heating, ventilation, and air conditioning efficiencies; engine performance; and labor costs; and

(E) use geometric principles to develop and implement a plan for construction of a project such as a trailer, an agricultural structure, a storage facility, or a fence.

§130.6. Equine Science (One-Half Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one-half credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and

resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Equine Science, students will acquire knowledge and skills related to equine animal systems and the equine industry. Equine Science may address topics related to horses, donkeys, and mules. To prepare for careers in the field of animal science, students must enhance academic knowledge and skills, acquire knowledge and skills related to animal systems, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of equine science;

(B) demonstrate competencies related to resources, information, interpersonal skills, and systems of operation in equine science;

(C) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student analyzes equine science as it relates to the selection of horses. The student is expected to:

(A) recognize the importance of equine industries such as racing, rodeos, equestrian therapy, and the global food market; and

(B) evaluate and select horses based on purpose.

(4) The student knows how to provide proper nutrition using accepted protocols and processes to maintain animal performance. The student is expected to:

(A) determine nutritional requirements of horses;

(B) describe the anatomy and physiology of horses, including the skeletal, muscular, respiratory, reproductive, and circulatory systems; and

(C) explain methods of maintaining horse health and soundness.

(5) The student analyzes equine science as it relates to the management of horses. The student is expected to:

(A) select equipment and facilities for horses;

(B) demonstrate methods of handling horses safely; and

(C) identify the procedures for breeding horses per industry standards.

(6) The student identifies animal pests and diseases. The student is expected to:

(A) identify and describe the role of bacteria, fungi, viruses, genetics, and nutrition in disease;

(B) identify methods of disease control, treatment, and prevention;

(C) classify internal and external parasites, including treatment and prevention; and

(D) identify behavioral diseases such as cribbing, heaving, and wind sucking.

(7) The student compares and contrasts issues affecting the equine industry. The student is expected to:

(A) describe biotechnology issues related to the equine industry; and

(B) identify animal welfare policy pertaining to equine industries such as racing, rodeos, equestrian therapy, the global food market, and pharmaceutical research.

§130.7. Livestock Production (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Livestock Production, students will acquire knowledge and skills related to livestock and the livestock production industry. Livestock Production may address topics related to beef cattle, dairy cattle, swine, sheep, goats, and poultry. To prepare for careers in the field of animal science, students must attain academic skills and knowledge, acquire knowledge and skills related to animal systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of animal systems;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in animal systems;

(C) demonstrate knowledge of personal and occupational safety and health practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student demonstrates technical skills relating to the interrelated human, scientific, and technological dimensions of animal systems. The student is expected to:

(A) assess the importance of the United States' impact on world commodity markets;

(B) apply the principles of livestock breeding and nutrition to predict the impact of current advances in genetics; and

(C) examine the interrelationship of plants and animals in concepts such as forage identification, rotational grazing, and grass protein levels.

(4) The student performs technical skills related to livestock production. The student is expected to:

(A) gather performance data;

(B) describe common veterinary procedures and skills;

(C) practice proper animal restraint techniques;

(D) demonstrate identification techniques; and

(E) demonstrate effective management strategies such as financial planning and managing governmental regulations.

(5) The student explains anatomy and physiology related to nutrition, reproduction, health, and management of livestock species. The student is expected to:

(A) explain the skeletal, muscular, respiratory, reproductive, and circulatory systems of animals; and

(B) evaluate vital signs and normal behavior.

(6) The student determines nutritional requirements of ruminant and non-ruminant animals, including poultry. The student is expected to:

(A) describe the digestive systems of ruminant and non-ruminant animals;

(B) identify sources of nutrients and classes of feed;

(C) identify vitamins, minerals, and feed additives;

(D) formulate rations; and

(E) discuss feeding practices and feed quality issues.

(7) The student explains animal genetics and reproduction. The student is expected to:

(A) describe the reproductive systems of various livestock;

(B) explain the use of genetics in animal agriculture such as Expected Progeny Differences (EPDs), phenotype, and genotype;

(C) identify systems of animal breeding;

(D) research current and emerging technologies in animal reproduction such as cloning, embryo transfer, in vitro fertilization, and artificial insemination; and

(E) design and conduct experiments to support known principles of genetics.

(8) The student identifies animal pests and diseases. The student is expected to:

(A) identify and describe the role of bacteria, fungi, viruses, genetics, and nutrition in disease;

(B) identify methods of disease control, treatment, and prevention; and

(C) classify internal and external parasites, including treatment and prevention.

(9) The student knows the factors impacting commodity prices and costs. The student is expected to:

(A) evaluate the relationship between livestock commodity markets; and

(B) formulate rations based on least-cost factors.

(10) The student plans for dynamic changes in business operation. The student is expected to:

(A) design, conduct, and complete research to identify and solve livestock management problems; and

(B) use charts, tables, or graphs to prepare written summaries of data such as nutrition, digestion, and reproduction data obtained in a laboratory activity and an individual scientific research project.

§130.8. Small Animal Management (One-Half Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one-half credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Small Animal Management, students will acquire knowledge and skills related to small animals and the small animal management industry. Small Animal Management may address topics related to small mammals such as dogs and cats, amphibians, reptiles, and birds. To prepare for careers in the field of animal science, students must enhance academic knowledge and skills, acquire knowledge and skills related to animal systems, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of specialty agricultural enterprises;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in specialty agricultural enterprises;

(C) demonstrate knowledge of personal and mechanical safety and health practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student describes the importance of responsible small animal ownership. The student is expected to:

(A) explain the domestication and use of small animals;

(B) identify the influence small animals have on society;

(C) describe the importance of the small animal industry;

(D) describe the obligations and benefits of small animal ownership; and

(E) discuss the use and services provided by small animals.

(4) The student learns the hazards associated with working in the small animal industry. The student is expected to:

(A) explain the importance of safe practices when working with small animals;

(B) identify zoonotic diseases that can be transmitted from small animals to humans;

(C) describe methods of preventing the spread of disease;

(D) follow safety guidelines when handling dangerous chemicals and working with small animals; and

(E) demonstrate the proper use of laboratory equipment.

(5) The student evaluates current topics in animal rights and animal welfare. The student is expected to:

(A) compare and contrast animal rights and animal welfare;

(B) research important persons, organizations, and groups involved in the animal rights movement;

(C) create a timeline of dates and acts of legislation related to animal welfare; and

(D) analyze current issues in animal rights and animal welfare.

(6) The student knows the care and management requirements for a variety of small animals. The student is expected to:

(A) discuss the physical characteristics for each species studied;

(B) list the breeds or types of each species studied as appropriate;

(C) discuss the habitat, housing, and equipment needs for each species studied;

(D) compare and contrast nutritional requirements for each species studied;

(E) explain health maintenance in each species studied, including the prevention and control of diseases and parasites;

(F) describe and practice common methods of handling each species studied; and

(G) perform procedures such as fecal and blood testing and basic grooming procedures using available laboratory equipment.

(7) The student examines career opportunities in small animal care. The student is expected to:

(A) identify, describe, and compare career opportunities in small animal care and management; and

(B) describe the nature of the work, salaries, and educational requirements for careers in small animal care.

§130.9. Veterinary Medical Applications (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Equine Science, Small Animal Management, or Livestock Production. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Veterinary Medical Applications covers topics relating to veterinary practices, including practices for large and small animal species. To prepare for careers in the field of animal science, students must attain academic skills and knowledge, acquire technical knowledge and skills related to animal systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of veterinary science;

(B) demonstrate competencies related to resources, information, interpersonal skills, and systems of operation in veterinary science;

(C) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student researches current topics in veterinary medicine, recognizes the importance of animals in society, and discusses professional ethics and laws that relate to veterinary medicine. The student is expected to:

(A) explain the human-animal bond and how to interact with clients and their animals;

(B) identify trends, issues, and historical events that have influenced animal use and care;

(C) describe the legal aspects of animal welfare and animal rights;

(D) evaluate the principles of veterinary medical ethics; and

(E) review policies and procedures in veterinary medicine that reflect various local, state, and federal laws.

(4) The student evaluates veterinary hospital management and marketing to determine their importance to the success of veterinary clinics and hospitals. The student is expected to:

(A) identify skills needed to communicate effectively with clients and pet owners in the community;

(B) identify vital information and demonstrate effective communication skills necessary to solve problems;

(C) explain the role and importance of marketing and its effects on the success of a veterinary hospital; and

(D) develop skills involving the use of electronic technology commonly found in a veterinary hospital such as centrifuge, autoclave, and radiography positions.

(5) The student communicates the importance of medical terminology, evaluates veterinary terms to discover their meanings, and demonstrates the ability to use terms correctly. The student is expected to:

(A) analyze veterinary terms to discover their meanings and recognize common Greek and Latin prefixes, suffixes, and roots;

(B) use directional anatomical terms appropriately;

(C) identify anatomical structures of animals;

(D) describe the major body systems using appropriate medical terminology; and

(E) recognize, pronounce, spell, and define medical terms relating to diagnosis, pathology, and treatment of animals.

(6) The student explores the area of animal management as it relates to animal identification, animal characteristics, and behavioral temperament. The student is expected to:

(A) identify a variety of animal species such as companion, exotic, and large animal species according to common breed characteristics;

(B) recognize common animal behavioral problems within companion, exotic, and large animals per industry standard;

(C) identify correct handling protocols and discuss their relevance to veterinary medical staff; and

(D) demonstrate appropriate methods of handling a variety of animal behaviors.

(7) The student investigates the body systems and gains a working knowledge of each system's purpose and functions and how each system is affected by disease. The student is expected to:

(A) identify the parts of the skeletal, muscular, respiratory, circulatory, digestive, endocrine, and nervous systems;

(B) describe the functions of the skeletal, muscular, respiratory, circulatory, digestive, endocrine, and nervous systems;

(C) identify appropriate anatomical sites for injections, measuring vital signs, and collecting blood samples for various animal species; and

(D) describe normal animal behavior and vital signs compared to sick animals using medical terminology.

(8) The student performs mathematical calculations used in veterinary medicine. The student is expected to:

(A) add, subtract, multiply, and divide whole numbers, fractions, and decimals as related to veterinary medicine;

(B) apply mathematical skills needed for accurate client assessment such as measurement, conversion, and data analysis;

(C) solve veterinary problems by calculating percentages and averages;

(D) convert between English and metric units;

(E) determine weight, volume, and linear measurements using scientific calculations;

(F) solve word problems using ratios and dimensional analysis;

(G) interpret data using tables, charts, and graphs; and

(H) calculate and prepare chemical concentrations using mathematical equations.

(9) The student evaluates animal diseases and identifies internal, external, and protozoal parasites. The student is expected to:

(A) identify factors that influence the health of animals;

(B) identify pathogens and describe the effects that diseases have on various body systems;

(C) explain courses of treatment for common viral and bacterial diseases;

(D) describe the process of immunity and disease transmission;

(E) identify internal, external, and protozoal parasites using common and scientific names;

(F) describe life cycles of common parasites;

(G) explain how parasites are transmitted and their effect on the host;

(H) conduct parasitic diagnostic procedures; and

(I) describe types of treatments for diseases and parasites.

(10) The student evaluates an animal's health during a clinical examination. The student is expected to:

(A) describe the characteristics and signs of a healthy animal;

(B) recognize examples of abnormalities and relate them to their associated problems and illnesses;

(C) take temperature, pulse, and respiration for a variety of animals;

(D) describe effects of age, stress, and environmental factors on vital signs of animals;

(E) explain procedures for physical examinations; and

(F) explain the regional approach to assess an animal's health.

(11) The student identifies imaging equipment and demonstrates how to safely operate and maintain equipment. The student is expected to:

(A) identify imaging equipment such as an ultrasonograph, endoscope, electrocardiograph, and radiograph;

(B) explain safety procedures, maintenance, and operation of imaging equipment; and

(C) demonstrate patient restraint and positioning methods used for imaging purposes.

(12) The student determines nutritional requirements for ruminant and non-ruminant animals and communicates the importance of animal nutrition in maintaining a healthy animal. The student is expected to:

(A) identify the anatomy of the digestive system of ruminant and non-ruminant animals;

(B) describe the process of digestion in ruminant and non-ruminant animals;

(C) identify types and sources of nutrients and classes of feeds;

(D) identify feed additives and describe how additives affect the food supply;

(E) evaluate animal dietary needs and feeding factors;

(F) calculate energy requirements and formulate rations;

(G) discuss feeding practices and feed-quality issues; and

(H) analyze the quality of commercially prepared feeds.

(13) The student examines various aspects of clinical hematology. The student is expected to:

(A) describe laboratory tests and explain the importance of proper laboratory procedures;

(B) demonstrate the procedures used in collecting, handling, preparing, and examining fecal, blood, and urine specimens;

(C) discuss normal and abnormal results obtained in complete blood counts;

(D) explain sensitivity testing and how to read testing results; and

(E) prepare microscope slides, preserve specimens, and perform several of the most common laboratory tests such as fecal flotations, microfilaria smear, and packed cell volume.

(14) The student identifies hospital procedures, skills, and objectives that are included in the job description of an animal care assistant. The student is expected to:

(A) explain the care, maintenance, and use of equipment and instruments found in veterinary practice;

(B) explain appropriate hospital procedures;

(C) discuss emergency protocols and describe first aid procedures, including cardiopulmonary resuscitation, control of bleeding, and treatment for shock, for small and large animals;

(D) demonstrate animal care skills such as administering medications, nail trimming, bathing, grooming, ear cleaning, expressing anal sacs, dental prophylaxis, enema administration, and identification of animals;

(E) demonstrate therapeutic care such as patient observation, maintaining and administering fluids, applying bandages, caring for open wounds, and managing hydrotherapy and physical therapy; and

(F) describe skills involved in the reproductive and genetic evaluation of animals.

(15) The student identifies and discusses surgical-assisting procedures, skills, and objectives that are included in the job description of an animal care assistant. The student is expected to:

(A) explain the protocol for pre-surgical and post-surgical care of a patient;

(B) describe methods used in the sterilization and preparation of small and large animal surgery packs;

(C) review skills involved in patient and surgical room preparation;

(D) describe surgical procedures such as castration, dehorning, and docking;

(E) describe care of newborn, orphan, and recumbent patients; and

(F) identify and monitor equipment used in surgical procedures.

(16) The student identifies pharmacology-assisting procedures, skills, and objectives that are included in the job description of an animal care assistant. The student is expected to:

(A) identify medications according to their classification, form, routes, and methods of administration;

(B) explain handling and distribution, protocol, and laws for controlled substances, including the U.S. Drug Enforcement Agency;

(C) calculate dosage using factors such as concentration of drug, weight of animal, and required dosage;

(D) complete a prescription label with identifiers that are required by the U.S. Food and Drug Administration; and

(E) select equipment and instruments used to give medications.

§130.10. Advanced Animal Science (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Biology, Chemistry, or Integrated Physics and Chemistry (IPC); Algebra I and Geometry; and either Small Animal Management, Equine Science, or Livestock Production. Recommended prerequisite: Veterinary Medical Applications. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Advanced Animal Science examines the interrelatedness of human, scientific, and technological dimensions of livestock production. Instruction is designed to allow for the application of scientific and technological aspects of animal science through field and laboratory experiences. To prepare for careers in the field of animal science, students must attain academic skills and knowledge, acquire knowledge and skills related to animal systems, and develop knowledge and skills regarding career opportunities, entry requirements, and industry standards. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.

(5) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.

(6) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(8) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(9) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of animal systems;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in animal systems;

(C) demonstrate knowledge of personal and occupational safety and health practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations; and

(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:

(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section;

(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;

(C) know that scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science are created and new technologies emerge;

(D) distinguish between scientific hypotheses and scientific theories;

(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(G) analyze, evaluate, make inferences, and predict trends from data; and

(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as accredited scientific journals, institutions of higher learning, current events, news reports, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) evaluate the impact of scientific research on society and the environment;

(E) evaluate models according to their limitations in representing biological objects or events; and

(F) research and describe the history of biology and contributions of scientists.

(5) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(6) The student demonstrates principles related to the human, scientific, and technological dimensions of animal agriculture and the resources necessary for producing domesticated animals. The student is expected to:

(A) evaluate market classes and grades of livestock;

(B) identify animal products such as organic and farm-raised and consumption patterns relative to human diet and health issues; and

(C) describe the growth and development of livestock as a global commodity.

(7) The student applies the principles of reproduction and breeding to livestock improvement. The student is expected to:

(A) describe reproductive cycles and relate them to breeding systems;

(B) explain the embryo transfer process and how it can impact livestock industries;

(C) recognize the significance of meiosis to sexual reproduction; and

(D) evaluate animal behavior and its relationship to livestock management.

(8) The student applies the principles of molecular genetics and heredity. The student is expected to:

(A) explain Mendel's laws of inheritance by predicting genotypes and phenotypes of offspring using the Punnett square;

(B) predict genotypes and phenotypes of animal offspring using Mendelian or non-Mendelian patterns of inheritance in various forms of livestock and use Punnett Square and assign alleles to justify all predictions;

(C) identify the parts of the nucleotide and the difference between the nucleotides found in deoxyribonucleic acid (DNA) versus ribonucleic acid (RNA);

(D) explain the functions of DNA and RNA;

(E) describe how heredity is used in the selection of livestock such as knowing the difference between outbreeding and inbreeding/linebreeding; and

(F) explain how traits are passed from parent to offspring through genetic transfer and the implications of breeding practices.

(9) The student examines and compares animal anatomy and physiology in livestock species. The student is expected to:

(A) identify and compare the external anatomy of livestock species;

(B) compare the anatomy and physiology of the skeletal, muscular, reproductive, digestive, circulatory, genito-urinary, respiratory, nervous, immune, and endocrine systems of animals;

(C) describe interactions among various body systems such as circulatory, respiratory, and muscular systems; and

(D) identify and describe the functions of epithelial, nervous, connective, and muscular tissue and relate the functions to animal body systems.

(10) The student determines nutritional requirements of ruminant and non-ruminant animals. The student is expected to:

(A) describe the structures and functions of the digestive system of ruminant animals, including cattle, and non-ruminant animals, including poultry;

(B) identify and describe sources of nutrients and classes of feeds and relate them to ruminant and non-ruminant animals;

(C) identify and describe vitamins, minerals, and feed additives and how they relate to the nutritional requirements of ruminant and non-ruminant animals;

(D) formulate rations based on different nutritional requirements;

(E) analyze feeding practices in relation to nutritional requirements of animals; and

(F) analyze feed quality issues and determine their effect on animal health.

(11) The student evaluates animal diseases and parasites. The student is expected to:

(A) identify factors that influence the health of animals such as geographic location, age, genetic composition, and inherited diseases for a particular species;

(B) identify pathogens and describe the effects that diseases have on various body systems;

(C) explain the methods of prevention, control, and treatment for diseases;

(D) describe the process of immunity and disease transmission;

(E) explain how external and internal parasites are transmitted and the effect they have on the host;

(F) explain the methods of prevention, control, and treatment of internal and external parasites;

(G) describe the life cycles of various parasites and relate them to animal health issues; and

(H) conduct parasite diagnostic tests.

(12) The student defines how an organism grows and how specialized cells, tissues, and organs develop. The student is expected to:

(A) compare cells from different parts of animals, including epithelia, muscles, and bones, to show specialization of structure and function;

(B) describe and explain cell differentiation in the development of organisms; and

(C) sequence the levels of organization in animals and relate the parts to each other and to the whole.

(13) The student demonstrates an understanding of policies and issues in animal science. The student is expected to:

(A) discuss the effects of biotechnology such as cloning, artificial insemination, and freezing of semen and embryos on the production of livestock;

(B) analyze the issues surrounding animal welfare and the humane treatment of livestock;

(C) apply principles of nutrition to maximize feed efficiency for livestock;

(D) design, conduct, and complete research to solve a self-identified problem in scientific animal agriculture; and

(E) analyze the issues surrounding the impact of livestock production on the environment.

(14) The student discusses livestock harvesting operations. The student is expected to:

(A) map the stages of animal growth and development and how they relate to market readiness;

(B) describe the harvesting process;

(C) describe federal and state meat inspection standards such as safety, hygiene, and quality control standards; and

(D) identify retail and wholesale cuts of meat and meat by-products and correlate to major muscle groups.

(15) The student explores methods of marketing livestock. The student is expected to:

(A) compare various methods of marketing livestock; and

(B) describe methods of marketing meat and meat products.

§130.11. Energy and Natural Resource Technology (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: a minimum of one credit from the courses in the Agriculture, Food, and Natural Resources Career Cluster. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Energy and Natural Resource Technology examines the interrelatedness of environmental issues and production agriculture. Students will evaluate the environmental benefits provided by sustainable resources and green technologies. Instruction is designed to allow for the application of science and technology to measure environmental impacts resulting from production agriculture through field and laboratory experiences. To prepare for careers in environmental service systems, students must attain academic skills and knowledge, acquire advanced technical knowledge and skills related to environmental service systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the field of energy and natural resources;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in energy and natural resources;

(C) demonstrate knowledge of personal and occupational safety, environmental regulations, and first-aid policy in the workplace; and

(D) analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student uses instructional time to conduct field and laboratory investigations using safe, environmentally appropriate, and ethical practices in a supervised agriculture experience. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations in a supervised agriculture experience; and

(B) use accepted procedures for the use and conservation of resources and for the safe handling of materials.

(4) The student discusses the importance and scope of natural resources. The student is expected to:

(A) identify various types of natural resources;

(B) discuss renewable and non-renewable energy resources and their impact on the environment;

(C) analyze the impacts of natural resources and their effects on the agricultural economy; and

(D) map the geographic and demographic uses of natural resources.

(5) The student identifies water use and management in agricultural settings. The student is expected to:

(A) identify the distribution and properties of water in the hydrologic cycle;

(B) identify agricultural uses of water such as recycling;

(C) discuss how agricultural uses may impact water resources;

(D) define point source and non-point source pollution;

(E) identify sources of point source and non-point source pollution associated with agriculture;

(F) evaluate how the different agricultural water uses may impact water availability; and

(G) research water use legislation.

(6) The student describes air quality associated with agricultural production. The student is expected to:

(A) describe the components of the atmosphere and the atmospheric cycle;

(B) define air pollution;

(C) analyze air quality legislation;

(D) identify sources and effects of air pollution from agricultural production;

(E) discuss different emission management strategies; and

(F) identify common air pollution controls used in agricultural production.

(7) The student examines soil erosion as related to agricultural production. The student is expected to:

(A) identify agricultural production practices that can contribute to soil erosion;

(B) analyze effects of soil erosion;

(C) discuss the legal aspects of soil erosion; and

(D) identify soil erosion control methods and programs.

(8) The student explains the effects of natural resource use. The student is expected to:

(A) identify the progression of use of natural resources leading to environmental degradation;

(B) explain the impact of human population dynamics on the environment;

(C) discuss the abuse of natural resources; and

(D) communicate the environmental consequences of natural resource use such as the impact on living organisms.

§130.12. Advanced Energy and Natural Resource Technology (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Recommended prerequisites: a minimum of one credit from the courses in the Agriculture, Food, and Natural Resources Career Cluster and Energy and Natural Resource Technology. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Advanced Energy and Natural Resource Technology is designed to explore the interdependency of the public and natural resource systems related to energy production. In addition, renewable, sustainable, and environmentally friendly practices will be explored. To prepare for careers in the field of energy and natural resource systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to energy and natural resources and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the field of energy and natural resources;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in energy and natural resources;

(C) demonstrate knowledge of personal and occupational safety, environmental regulations, and first aid policy in the workplace; and

(D) analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student uses instructional time to conduct field and laboratory investigations using safe, environmentally appropriate, and ethical practices in a supervised agriculture experience. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations in a supervised agriculture experience; and

(B) apply accepted procedures for the use and conservation of resources and for the safe handling of materials.

(4) The student determines and evaluates the importance and scope of energy and natural resources. The student is expected to:

(A) identify various types of natural resources;

(B) identify renewable, non-renewable, and sustainable energy resources and determine their availability;

(C) evaluate the impacts of energy production on natural resources and the agricultural economy; and

(D) analyze the geographic and demographic uses of natural resources.

(5) The student analyzes ethical issues related to natural resource management and energy production. The student is expected to:

(A) compile examples of different lease agreements used for leasing minerals and natural resources;

(B) interpret legal documents related to natural resource management and energy production; and

(C) compare and contrast public and industry interest in natural resource management.

(6) The student understands the role of natural resource management and energy production policies at the local, state, and national levels. The student is expected to:

(A) identify policy affecting the use of natural resources;

(B) identify policy affecting energy production;

(C) research controls that protect Earth's natural resources;

(D) identify state and federal agencies that have natural resource management and energy production responsibilities; and

(E) define the roles of government, society, and property owners in the development of natural resource management and energy production policy.

(7) The student recognizes the purpose of land use planning for natural resource management and energy production. The student is expected to:

(A) discuss advantages and disadvantages of land use planning for natural resource management and energy production; and

(B) compare and contrast land use policy trends within the state.

(8) The student identifies water use and wastewater management. The student is expected to:

(A) identify municipal, industrial, and agricultural uses of water;

(B) explore and develop water recycling opportunities;

(C) evaluate sources of point and non-point source pollution associated with municipal, industrial, and agricultural uses;

(D) describe effective management practices commonly used to abate point and non-point sources of pollution;

(E) analyze how water use impacts water availability;

(F) research water use legislation;

(G) discuss water quality policy and how it affects the decisions made in agricultural production; and

(H) discuss the interaction of energy production and water resources.

(9) The student describes air quality associated with natural resource management and energy production. The student is expected to:

(A) research air quality legislation;

(B) identify sources and effects of air pollution;

(C) discuss different emission management strategies; and

(D) identify air pollution controls used in energy production.

(10) The student examines soil erosion as related to natural resource management and energy production. The student is expected to:

(A) examine the effects of natural resource management and energy production on soil erosion;

(B) analyze the components and functions of soils;

(C) appraise soil and water conservation programs; and

(D) compare soil erosion control methods.

(11) The student analyzes the identification, handling, storing, and disposing of waste and hazardous materials. The student is expected to:

(A) classify types of waste and hazardous materials;

(B) research legislation related to waste and hazardous materials;

(C) select appropriate entities responsible for waste and hazardous material management; and

(D) describe safe handling, storing, and disposal of waste materials such as composting and recycling.

(12) The student learns the processes for producing energy and green products from agricultural, biomass, fossil fuel, wind, solar, and geothermal sources. The student is expected to:

(A) identify agricultural and silvicultural crops and bio-products suitable for renewable production;

(B) discuss production processes for agricultural- and silvicultural-based bio-products;

(C) describe the fundamentals for non-renewable resource recovery;

(D) analyze the effects of non-renewable resource recovery methods and the environmental considerations associated with each method such as environmentally friendly alternatives;

(E) analyze the advantages and disadvantages of wind-generated energy;

(F) identify public policy considerations associated with transmission line construction to transport wind-generated energy;

(G) locate areas in the state that have geothermal energy production potential;

(H) explain the benefits of geothermal energy;

(I) identify solar energy systems and describe the function of each; and

(J) identify the environmental considerations associated with biofuels.

§130.13. Oil and Gas Production I (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Oil and Gas Production I, students will identify specific career opportunities and skills, abilities, tools, certification, and safety measures associated with each career. Students will also understand components, systems, equipment, and production and safety regulations associated with oil and gas wells. To prepare for careers in oil and gas production, students must attain academic skills and knowledge, acquire technical knowledge and skills related to oil and gas production and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the oil and gas production field;

(B) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation;

(C) demonstrate knowledge of personal and occupational safety, environmental regulations, and first-aid policy in the workplace;

(D) analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills; and

(E) demonstrate leadership skills to accomplish organizational goals and objectives.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student understands the history and process for drilling a well. The student is expected to:

(A) describe the history of drilling for petroleum in the United States and abroad;

(B) describe and appraise routine drilling operations, offshore drilling, and new drilling technologies;

(C) describe the tools and techniques for directional drilling;

(D) examine the differences between fishing, retrieving, and repairing pipe;

(E) describe the methods for completing a well in order for production to begin;

(F) assess fluid pressure;

(G) determine how the flow is initiated in a new well;

(H) differentiate between major components of a well and discuss the purpose, design, and operation of each component;

(I) describe activities associated with completing a well;

(J) describe the well completion processes and equipment;

(K) summarize the instruments and techniques used when logging and testing during the drilling and completion of a well;

(L) list the factors that are analyzed when studying a poorly producing well; and

(M) identify the responsibilities, characteristics, abilities, and work behaviors of personnel that are involved in well service.

(4) The student discusses and identifies components, systems, equipment, production, and safety regulations associated with oil and gas wells. The student is expected to:

(A) identify the major systems and equipment used in the production of oil and gas;

(B) identify and describe the wellhead equipment that controls fluid flow;

(C) trace the process flow through the oil and gas production systems and equipment;

(D) discuss the purpose of the wellhead and identify the major components;

(E) describe the purpose, design, and operation of each wellhead component;

(F) compare and contrast the major differences in wellhead construction;

(G) compare and contrast onshore and offshore facilities;

(H) compare and contrast oil and gas regions within the United States;

(I) describe the safety, health, and environmental concerns associated with working around a wellhead;

(J) explain how the wellhead system affects other production systems tied to the wellhead;

(K) describe the activities associated with monitoring and regulating well flow;

(L) describe the wellhead maintenance activities performed by the production technician;

(M) operate and troubleshoot a wellhead using a computer simulator, pilot plant, or tabletop unit; and

(N) identify the operating conditions that would warrant a manual or automatic shut-in of a well and steps involved in a manual shut-in of a well.

(5) The student discusses safety issues related to the oil and gas industry. The student is expected to:

(A) describe the safety, health, and environmental concerns associated with drilling, production, and maintenance; and

(B) research safety standards in the petroleum industry such as the Bureau of Safety and Environmental Enforcement (BSEE), United States Coast Guard (USCG), American Petroleum Institute (API), Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), American Society for Testing and Materials (ASTM), American National Standards Institute (ANSI), and others.

§130.14. Oil and Gas Production II (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: Oil and Gas Production I. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Oil and Gas Production II, students will gain knowledge of the specific requirements for entry into post-secondary education and employment in the petroleum industry; research and discuss petroleum economics; research and discuss the modes of transportation in the petroleum industry; research and discuss environmental, health, and safety concerns; research and discuss different energy sources; and prepare for industry certification. To prepare for careers in oil and gas production, students must attain academic skills and knowledge, acquire technical knowledge and skills related to oil and gas production and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the field of agriculture, food, and natural resources;

(B) identify careers in agriculture, food, and natural resources with required aptitudes in science, technology, engineering, mathematics, language arts, and/or social studies;

(C) apply technology skills to create an electronic portfolio of skills and abilities;

(D) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in agriculture, food, and natural resources;

(E) demonstrate knowledge of personal and occupational safety, health, environmental regulations, and first-aid policy in the workplace; and

(F) analyze employers' expectations, including appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student researches and discusses the modes of transportation and environmental, health, and safety concerns. The student is expected to:

(A) describe evolution of transportation in the petroleum industry;

(B) research and access the various ground methods of transportation;

(C) survey health and safety policies, procedures, regulations, and practices as they relate to transportation in the petroleum industry;

(D) research and discuss petroleum economics;

(E) compare and contrast product marketing, sales, and distribution of petroleum products;

(F) identify supply chain businesses that create new supplies of oil and gas;

(G) identify supply creation companies and how they operate;

(H) discuss the factors in investment decision-making; and

(I) calculate rates of return to evaluate prospects.

(4) The student researches the different methods of disposing of oil and gas waste and methods of cleanup. The student is expected to:

(A) discuss the disposal methods of exploration and production wastes;

(B) identify cleanup methods for blowouts and spills; and

(C) identify refining processes that minimize environmental impact.

(5) The student researches and identifies the different energy sources and priorities for the oil and gas industry. The student is expected to:

(A) research the petroleum industry to identify renewable energy sources;

(B) present the challenges and priorities of the petroleum industry;

(C) research the critical technologies needed in the future; and

(D) research the nontechnical solutions to energy needs.

§130.15. Food Technology and Safety (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Food Technology and Safety examines the food technology industry as it relates to food production, handling, and safety. To prepare for careers in value-added and food processing systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to value-added and food processing and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify and locate career opportunities that appeal to personal career goals;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in food processing;

(C) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student explains the impact of food science systems. The student is expected to:

(A) explain the significance of food science systems;

(B) define trends in food production, world population, and supply and demand for food products;

(C) research trends in animal and food science research; and

(D) evaluate the relationship between biotechnology and the food science industry.

(4) The student analyzes the nutritive value of food constituents. The student is expected to:

(A) define the terms used in food technology;

(B) compare and contrast the nutritive value of food groups; and

(C) apply data and measurements to solve a problem related to food processing.

(5) The student identifies procedures and regulations for sanitation and safety in the food industry. The student is expected to:

(A) identify food industry inspection standards, including hazard analysis and critical control points;

(B) describe procedures for insect and rodent control;

(C) identify appropriate chemicals used in the food industry;

(D) assess conditions with regard to safety and health; and

(E) identify specific regulation for organic animal products, grains, and produce.

(6) The student identifies safety and governmental regulations involved in the processing and labeling of foods. The student is expected to:

(A) research regulations dealing with preserving red meat, poultry, and fish;

(B) describe packaging, labeling, and storage requirements for red meat, poultry, and fish;

(C) explain the impact of temperature in food preservation;

(D) compare and contrast packaging requirements; and

(E) evaluate cultural practices and exotic species in food harvesting and processing.

(7) The student demonstrates an understanding of the trends and issues important to careers in the food science industry by comparing and contrasting issues affecting the food science industry, including biotechnology, employment, safety, environmental, and animal welfare issues. The student is expected to:

(A) select solutions for different environmental issues;

(B) identify issues affecting food science;

(C) research history and policies related to food science issues;

(D) analyze and defend solutions for different environmental issues; and

(E) apply economic principles such as supply, demand, and profit to food science systems.

(8) The student describes the processing, packaging, quality analysis, and marketing of red meats and their by-products. The student is expected to:

(A) describe preparing livestock carcasses for market;

(B) describe the U.S. Department of Agriculture's inspection and grading procedures;

(C) identify wholesale and retail cuts;

(D) evaluate and grade beef, pork, lamb, and goat carcasses and wholesale cuts; and

(E) identify methods of fabricating and marketing processed meats.

(9) The student describes the processing, packaging, quality analysis, and marketing of eggs, poultry, and fish and their by-products. The student is expected to:

(A) describe processing techniques;

(B) demonstrate poultry and retail cuts evaluation;

(C) identify grades and classes of eggs, poultry, fish, and seafood;

(D) fabricate specialty and value-added products;

(E) demonstrate an understanding of quality and portion control procedures; and

(F) describe marketing procedures for eggs, poultry, fish, and seafood.

(10) The student describes the processing, packaging, quality analysis, and marketing of fruits, nuts, and vegetables and their by-products. The student is expected to:

(A) identify, classify, and grade fruits, nuts, and vegetables;

(B) demonstrate trimming, washing, waxing, peeling, blanching, and other marketing techniques;

(C) research critical issues in transporting, receiving, and storing fruits, nuts, and vegetables; and

(D) discuss preserving, packaging, and storing fruits, nuts, and vegetables.

(11) The student describes the processing, packaging, quality analysis, and marketing of milk and dairy products for distribution. The student is expected to:

(A) describe methods of preparing milk for processing;

(B) evaluate methods of processing milk and dairy products;

(C) identify dairy products, including cultured milk products and frozen dairy desserts; and

(D) process, classify, and grade cheese.

§130.16. Food Processing (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Food Technology and Safety. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Food Processing focuses on the food processing industry with special emphasis on the handling, processing, and marketing of food products. To prepare for careers in food products and processing systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to natural resources and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the food processing industry, including the value-added products industry;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in the food processing industry, including the value-added products industry;

(C) demonstrate knowledge of personal and occupational safety practices in the workplace;

(D) identify employers' expectations, including appropriate work habits, ethical conduct, and legal responsibilities;

(E) demonstrate characteristics of good citizenship such as stewardship, advocacy, and community leadership; and

(F) research career topics using technology such as the Internet.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student knows the relationship of the food processing industry to the free enterprise system. The student is expected to:

(A) explain the importance of the food processing industry in the free enterprise system; and

(B) explain trends in the consumption of food products.

(4) The student understands consumer satisfaction issues. The student is expected to:

(A) practice equipment maintenance and sanitation procedures;

(B) explain the factors that affect food palatability;

(C) fabricate red meat, poultry, game, and fish into wholesale and retail cuts; and

(D) demonstrate work ethics, customer relations skills, and management competencies consistent with industry standards.

(5) The student understands quality control issues in food processing. The student is expected to:

(A) practice procedures relating to the safe manufacture of foods through hygienic food handling and processing;

(B) develop and maintain sanitation schedules;

(C) describe hazard analysis and critical control point implementation issues;

(D) research food safety laws; and

(E) describe solutions for different environmental issues.

(6) The student identifies marketing considerations for food processing. The student is expected to:

(A) practice methods of merchandising red meat, poultry, game, fish, and their by-products;

(B) identify, select, and grade meat;

(C) develop food preservation programs using appropriate food preservation methods;

(D) explain the impact of temperature in food preservation;

(E) compare and contrast preservation packaging such as film, plastic, and cans;

(F) describe harvest and inspection techniques to process food products and analyze food product options; and

(G) identify specific criteria for organic food processing and marketing.

§130.17. Wildlife, Fisheries, and Ecology Management (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 9-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Wildlife, Fisheries, and Ecology Management examines the management of game and non-game wildlife species, fish, and aquacrops and their ecological needs as related to current agricultural practices. To prepare for careers in natural resource systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to natural resources, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the field of natural resources;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in natural resources;

(C) demonstrate knowledge of personal and occupational safety and health, environmental regulations, and first-aid policy in the workplace; and

(D) analyze employers' expectations such as appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student analyzes the importance of wildlife, with an emphasis on use and management. The student is expected to:

(A) analyze the importance of wildlife, fisheries, and ecology management;

(B) discuss the history of wildlife, fisheries, and ecology management;

(C) discuss policies, laws, and the administration of wildlife, fisheries, and ecology management; and

(D) analyze the economic impact of public recreation.

(4) The student knows the scientific basis of and applies concepts related to wildlife management. The student is expected to:

(A) analyze the basic ecological concepts of game management;

(B) identify game, non-game, upland, and migratory game birds, water fowl, furbearers, freshwater and salt water fish, predators, and protected endangered species;

(C) describe and assess the management of wildlife populations;

(D) identify diseases and parasites impacting wildlife species;

(E) discuss the appropriate method of reporting disease and parasite outbreaks;

(F) identify plants impacting aquaculture and wildlife management practices; and

(G) discuss habitat and food plot management to benefit aquaculture and wildlife species.

(5) The student knows the interrelationship between various aspects of wildlife and outdoor public use management. The student is expected to:

(A) discuss the importance and role of the Wildlife Management Areas of Texas in the management of private and public lands;

(B) identify laws and regulations regarding the use of wildlife resources;

(C) apply laws and regulations regarding recreation safety such as angler, archer, boater, and hunter safety;

(D) compare and contrast public and private land use;

(E) identify appropriate safety certification requirements;

(F) recognize precautions to use when interfacing with the public concerning regulations and law enforcement;

(G) describe security issues for closed and restricted areas;

(H) recognize potential threat situations for the public of dangers on public and private lands;

(I) recognize the role of law enforcement; and

(J) summarize wildlife and fish harvest techniques and procedures.

(6) The student examines natural cycles and ecological concepts. The student is expected to:

(A) explain the hydrologic, nitrogen, carbon, and nutrient cycles;

(B) evaluate the impact of natural cycles on succession;

(C) analyze the effects of natural cycles on population dynamics;

(D) distinguish between primary and secondary producers;

(E) compare and contrast predator-prey relationships;

(F) evaluate the effects of pollution sources; and

(G) evaluate riparian zones.

(7) The student applies cartographic skills to natural resource activities. The student is expected to:

(A) compare and contrast types of maps;

(B) interpret map features and legends;

(C) compare map scale to actual distance;

(D) evaluate elevation and terrain features from topographic maps;

(E) use land survey and coordinate systems; and

(F) locate position and interpret images using a geospatial interface.

(8) The student evaluates planning data by monitoring natural resource status. The student is expected to:

(A) identify resource inventory and population studies;

(B) devise sample plots and points;

(C) identify and locate resources;

(D) interpret data concerning resource availability and health;

(E) organize databases of resource data; and

(F) create a technical report.

(9) The student analyzes various natural resource enhancement techniques using scientific knowledge. The student is expected to:

(A) develop a riparian zone enhancement technique plan;

(B) evaluate wildlife habitat enhancement plans; and

(C) evaluate public use and recreation area enhancement plans.

(10) The student demonstrates concepts related to optimum production. The student is expected to:

(A) discuss the importance and progress of aquaculture as an emerging industry;

(B) describe nutritional requirements of aquaculture production;

(C) identify requirements for optimum growth of species-specific aqua crops/aquaculture products; and

(D) identify appropriate treatments for diseases and parasites impacting wildlife species and aquaculture.

§130.18. Forestry and Woodland Ecosystems (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and

resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Forestry and Woodland Ecosystems examines current management practices for forestry and woodlands. Special emphasis is given to management as it relates to ecological requirements and how these practices impact the environment. To prepare for careers in natural resource systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to natural resources, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the field of forestry and woodland ecosystems;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in forestry and woodland ecosystems;

(C) demonstrate knowledge of personal and occupational safety, health, environmental regulations, and first-aid policy in the workplace; and

(D) analyze employers' expectations, including appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student describes the principles of forestry and woodland ecosystems. The student is expected to:

(A) describe the historical and economic significance of forestry;

(B) illustrate tree anatomy and morphology;

(C) differentiate between species of trees;

(D) classify forest and woodland soils;

(E) describe silviculture;

(F) compare and contrast forest and woodland ecosystems;

(G) describe photosynthesis and respiration as they relate to forest and woodland species;

(H) describe watershed management as it relates to forest and woodland ecosystems;

(I) describe sexual and asexual reproduction in forest and woodland species;

(J) define succession; and

(K) compare natural and managed forests and woodlands.

(4) The student demonstrates forestry biometrics skills. The student is expected to:

(A) calculate tree volume;

(B) estimate timber growth and yield;

(C) evaluate forest and woodland quality by cruising timber stands; and

(D) scale logs to calculate their quality and volume.

(5) The student demonstrates knowledge of forestry management skills. The student is expected to:

(A) identify forestry management techniques;

(B) discuss multiple-use possibilities for forest and woodlands areas; and

(C) develop a control plan for destructive agents such as fire, insects, and disease.

(6) The student identifies softwood and hardwood forest management and use practices. The student is expected to:

(A) identify principles of forestry economics;

(B) research sources of forestry management assistance;

(C) identify harvesting practices and equipment;

(D) describe merchandising practices; and

(E) evaluate research in forestry and wood technology.

(7) The student describes the role of wood technology in forest product development. The student is expected to:

(A) compare timber manufacturing processes and products; and

(B) discuss research and development issues in forestry and wood technology.

(8) The student applies cartographic skills to natural resource activities. The student is expected to:

(A) compare and contrast types of maps;

(B) interpret map features and legends;

(C) compare map scale to actual distance;

(D) evaluate elevation and terrain features from topographic maps;

(E) use land survey and coordinate systems; and

(F) locate position and interpret images using a geospatial interface.

§130.19. Range Ecology and Management (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Range Ecology and Management is designed to develop students' understanding of rangeland ecosystems and sustainable forage production. To prepare for careers in environmental and natural resource systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to environmental and natural resources, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development, education, and entrepreneurship opportunities in the field of environmental and natural resources;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in environmental and natural resources;

(C) demonstrate knowledge of personal and occupational safety, health, environmental regulations, and first-aid policy in the workplace; and

(D) analyze employers' expectations, including appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student develops an understanding of the rangeland ecosystem. The student is expected to:

(A) describe ecology, photosynthesis, energy flow, and climax vegetation;

(B) describe the impact of rangeland on the water cycle and water quality; and

(C) determine capabilities and limitations of rangelands.

(4) The student develops an understanding of rangeland as a dynamic, living, and changeable system. The student is expected to:

(A) explain the relationship of rangeland to the environment;

(B) discuss the interrelationships among water, alternative use, carrying capacity, and population;

(C) identify and classify native, non-native, and invasive plants and animals in the rangeland ecosystem;

(D) explore the use of rangeland plants as alternative energy sources;

(E) develop an understanding of the role of rangeland in water recharge and conservation; and

(F) recognize the importance of successful rangeland ecology practices.

(5) The student analyzes the biotic and abiotic components of a rangeland. The student is expected to:

(A) discuss components of rangeland with an emphasis on soil;

(B) determine components of rangeland with an emphasis on topography; and

(C) classify range sites by soil properties;

(6) The student develops an understanding of the dynamic process of a renewable rangeland resource. The student is expected to:

(A) determine range condition based on plant populations;

(B) compare and contrast rangeland condition trends; and

(C) formulate methods to improve range conditions.

(7) The student identifies methods of maintaining and improving rangeland for livestock management. The student is expected to:

(A) identify plants beneficial to livestock;

(B) identify plant species harmful to livestock;

(C) analyze how livestock use range plants; and

(D) discuss livestock grazing management.

(8) The student identifies methods of maintaining and improving rangeland for wildlife management. The student is expected to:

(A) identify plants beneficial to wildlife;

(B) identify plants species harmful to wildlife;

(C) analyze how wildlife species use range plants; and

(D) discuss wildlife grazing management.

(9) The student develops an understanding of rangeland management as it relates to global concerns. The student is expected to:

(A) examine how rangeland characteristics affect aquifers;

(B) analyze how rangeland characteristics affect the environment;

(C) analyze how rangeland management affects the environment; and

(D) evaluate the impact of energy production systems on rangelands.

§130.20. Floral Design (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 9-12. This course satisfies the fine arts graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Floral Design is designed to develop students' ability to identify and demonstrate the principles and techniques related to floral design as well as develop an understanding of the management of floral enterprises. Through the analysis of artistic floral styles and historical periods, students will develop respect for the traditions and contributions of diverse cultures. Students will respond to and analyze floral designs, thus contributing to the development of lifelong skills of making informed judgments and evaluations. To prepare for careers in floral design, students must attain academic skills and knowledge, acquire technical knowledge and skills related to horticultural systems, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of floral design and interior landscape development;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in floral design and interior landscape development;

(C) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(D) identify employer expectations and appropriate work habits;

(E) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership; and

(F) identify training, education, and certification requirements for occupational choices.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student identifies design principles and techniques in floral art and interiorscapes. The student is expected to:

(A) identify the aesthetic benefits and the history of floral art, particularly as it relates to current practice;

(B) classify and identify flowers and plants used in floral design; and

(C) identify design elements and principles.

(4) The student demonstrates floral design principles and techniques. The student is expected to:

(A) demonstrate an understanding of and implement the design process through the medium of floral materials;

(B) evaluate and prepare geometric floral designs using cut flowers;

(C) evaluate and prepare geometric floral designs using silk flowers;

(D) prepare corsages and boutonnieres; and

(E) prepare floral designs for specific occasions.

(5) The student develops and formulates ideas from the environment. The student is expected to:

(A) illustrate ideas for floral designs from direct observation, experiences, and imagination;

(B) compare and contrast the use of art elements such as color, texture, form, line, and space; and

(C) compare and contrast art principles such as continuity, pattern, rhythm, balance, proportion, and unity in personal designs.

(6) The student makes informed judgments about personal designs and the designs of others. The student is expected to:

(A) interpret, evaluate, and justify artistic decisions in personal arrangements; and

(B) select and analyze original designs, portfolios, and floral exhibitions by peers and others to form precise conclusions about formal qualities and historical and cultural contexts, intents, and meanings.

(7) The student demonstrates contemporary designs, business practices, and creativity in the floral industry by developing floral design skills. The student is expected to:

(A) classify and identify specialty floral items;

(B) evaluate and appraise floral designs;

(C) prepare cost-effective designs;

(D) create specialty designs to expand artistic expression;

(E) demonstrate pricing and order-processing skills; and

(F) list service delivery options related to effectiveness.

(8) The student knows the management factors of floral enterprises. The student is expected to:

(A) use temperature, preservatives, and cutting techniques to increase keeping quality of floral materials;

(B) identify tools, chemicals, and equipment used in floral design;

(C) fertilize, prune, and water tropical plants;

(D) manage pests; and

(E) demonstrate technical skills for increasing the preservation of cut flowers and foliage.

§130.21. Landscape Design and Management (One-Half Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one-half credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Landscape Design and Management is designed to develop an understanding of landscape design and management techniques and practices. To prepare for careers in horticultural systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to horticultural systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of landscape design and management;

(B) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in landscape design and management;

(C) examine licensing, certification, and credentialing requirements to maintain compliance with industry requirements;

(D) demonstrate knowledge of personal and occupational health and safety practices in the industry;

(E) identify employers' expectations and appropriate work habits; and

(F) demonstrate characteristics of good citizenship such as advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student identifies environmental, aesthetic, and financial benefits of landscaped sites. The student is expected to:

(A) assess soil characteristics and environmental conditions;

(B) assess site for local conditions such as property lines, easement restrictions, and location of public utilities;

(C) complete a site analysis checklist;

(D) produce a site sketch using graphic design equipment or software;

(E) identify plants used in designing landscapes;

(F) identify structures and hardscape materials used in designing landscapes;

(G) create landscape designs demonstrating the application of design elements and principles; and

(H) analyze different landscape design styles and identify the different aesthetic and environmental factors of each style.

(4) The student performs landscape business procedures. The student is expected to:

(A) demonstrate skills for interviewing potential clients;

(B) develop landscape ideas from a checklist;

(C) prepare cost estimates and schedules for landscaping services, including materials, labor, and business costs; and

(D) analyze service contracts.

(5) The student analyzes the cost and maintenance of tools and equipment used in the landscape industry. The student is expected to:

(A) identify, store, and maintain landscaping hand tools and power equipment;

(B) analyze costs associated with purchasing and maintaining landscaping hand tools and power equipment;

(C) assess different landscape irrigation systems for efficiency, application, and environmental impact;

(D) identify common irrigation system components and materials; and

(E) examine local and state regulations affecting irrigation systems.

(6) The student performs landscape installation services. The student is expected to:

(A) prepare landscape sites for installation; and

(B) install landscape plants and structures using proper installation techniques.

(7) The student performs landscape maintenance services. The student is expected to:

(A) identify and demonstrate proper pruning techniques for different plant materials;

(B) recognize methods for renovating existing landscapes;

(C) analyze nutritional needs of plants;

(D) develop fertilization plans that address plant needs and environmental concerns;

(E) examine Integrated Pest Management in assessing an insect, pathogen, or weed problem;

(F) use pesticide application techniques and equipment properly;

(G) explain pesticide labeling and safety data sheets; and

(H) demonstrate lawn management techniques.

§130.22. Turf Grass Management (One-Half Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one-half credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Turf Grass Management is designed to develop an understanding of turf grass management techniques and practices. To prepare for careers in horticultural systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to horticultural systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of turf grass management;

(B) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation in turf grass management;

(C) examine licensing, certification, and legal requirements to maintain compliance with industry requirements;

(D) demonstrate knowledge of personal and occupational health and safety practices in the industry;

(E) identify employers' expectations and appropriate work habits; and

(F) demonstrate characteristics of good citizenship such as advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student identifies the environmental, aesthetic, and financial benefits of turf grass in residential, commercial, and athletic settings. The student is expected to:

(A) assess sites for environmental factors that impact turf grass establishment and management such as soil type, soil pH, and elevation differences;

(B) develop a site assessment checklist; and

(C) develop a site preparation plan.

(4) The student identifies and implements common cultural and physiological requirements for cool and warm season turf grass establishment. The student is expected to:

(A) identify turf grass varieties and cultivars that fulfill site requirements;

(B) identify pests and pathogens of turf grasses;

(C) identify common weeds found in turf grasses;

(D) determine the importance of site grading for water movement;

(E) determine the importance of soil compaction on turf grass establishment;

(F) reduce impact of compaction using aeration methods;

(G) compare establishment procedures such as seeding, sodding, sprigging, and hydromulching; and

(H) explain the importance of turf grass installation timing.

(5) The student identifies and implements common cultural and physiological requirements for cool and warm season turf grass maintenance. The student is expected to:

(A) explain and demonstrate mowing heights;

(B) explain the principle of mowing frequency;

(C) compare residential, commercial, and athletic turf maintenance needs;

(D) determine turf grass irrigation requirements;

(E) analyze and address thatch accumulation in turf grass;

(F) analyze nutritional needs of turf grass;

(G) develop fertilization plans that address turf grass needs and environmental concerns;

(H) examine Integrated Pest Management in assessing an insect, pathogen, or weed problem;

(I) use turf grass pesticide application techniques and equipment properly; and

(J) explain turf grass pesticide labeling and safety data sheets.

(6) The student performs turf grass management business procedures. The student is expected to:

(A) assess the needs of prospective clients;

(B) analyze material, labor, and business costs related to turf grass sites;

(C) develop and analyze service contracts and maintenance schedules;

(D) prepare a cost estimate for establishing a turf grass site, including materials and labor; and

(E) prepare a cost estimate for maintaining a turf grass site, including materials and labor.

(7) The student manages turf grass maintenance equipment. The student is expected to:

(A) identify, store, and maintain turf grass hand tools and power equipment;

(B) analyze the costs associated with turf grass hand tools and power equipment; and

(C) analyze components of turf grass irrigation systems.

§130.23. Horticultural Science (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Horticultural Science is designed to develop an understanding of common horticultural management practices as they relate to food and ornamental plant production. To prepare for careers in horticultural systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to horticulture and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer knowledge and skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of horticulture;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in horticulture;

(C) demonstrate knowledge of personal and occupational safety practices in the workplace;

(D) identify employer expectations and appropriate work habits; and

(E) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student develops technical skills associated with the management and production of horticultural plants. The student is expected to:

(A) classify horticultural plants based on physiology for taxonomic and other classifications;

(B) manage the horticultural production environment;

(C) propagate and grow horticultural plants;

(D) create a design using plants that demonstrates an application of design elements and principles;

(E) design and establish landscapes;

(F) describe the processes of fruit, nut, and vegetable production; and

(G) demonstrate proper pruning techniques.

(4) The student identifies structures and physiological processes used in plant production. The student is expected to:

(A) examine unique plant properties to identify and describe functional differences in plant structures, including roots, stems, flowers, leaves, and fruit;

(B) differentiate between monocots and dicots and male and female plants;

(C) germinate seeds and transplant seedlings; and

(D) demonstrate asexual propagation techniques.

(5) The student manages and controls common pests of horticultural plants. The student is expected to:

(A) identify common horticultural pests and pathogens;

(B) demonstrate safe practices in selecting, applying, storing, and disposing of chemicals; and

(C) explain parts of a pesticide label.

(6) The student demonstrates marketing and management skills used in the operation of horticultural businesses. The student is expected to:

(A) identify and maintain hand and power tools and equipment;

(B) select appropriate tools and equipment;

(C) demonstrate safe use of tools and equipment;

(D) identify options and opportunities for business ownership; and

(E) analyze the role of small business in free enterprise.

§130.24 Greenhouse Operation and Production (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Greenhouse Operation and Production is designed to develop an understanding of greenhouse production techniques and practices. To prepare for careers in horticultural systems, students must attain academic skills and knowledge, acquire technical knowledge and skills related to horticultural systems and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of greenhouse operations and production;

(B) apply competencies related to resources, information, interpersonal skills, problem solving, and critical thinking in greenhouse operations and production;

(C) examine licensing, certification, and legal requirements to maintain compliance with industry requirements;

(D) demonstrate knowledge of personal and occupational health and safety practices in the industry;

(E) identify employers' expectations and appropriate work habits; and

(F) demonstrate characteristics of good citizenship such as advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student identifies and classifies plants used in greenhouse production. The student is expected to:

(A) classify greenhouse plants according to taxonomy systems;

(B) develop knowledge of plant anatomy structures and functions for plant identification; and

(C) develop plant classifications based on cropping schedules and market demand for greenhouse crops.

(4) The student identifies and investigates different greenhouse structures and construction factors. The student is expected to:

(A) select greenhouse coverings;

(B) compare greenhouse styles and construction materials;

(C) analyze the costs associated with greenhouse construction;

(D) evaluate greenhouse site orientation and construction concerns;

(E) integrate other growing structures such as cold frames, hotbeds, lath houses, and potting sheds; and

(F) investigate local, state, and national regulations affecting greenhouse operations.

(5) The student identifies and assesses environmental conditions within the greenhouse. The student is expected to:

(A) investigate environmental factors controlled in the greenhouse;

(B) determine and calculate factors used in heating and cooling a greenhouse;

(C) investigate the effects of greenhouse climate conditions such as ventilation, carbon dioxide generation, and humidity on plant growth in the greenhouse;

(D) explore the importance of light quality, quantity, and duration on the production of greenhouse crops; and

(E) compare open and closed environmental systems in the greenhouse such as misting beds or hydroponics.

(6) The student identifies, operates, and maintains greenhouse environmental and mechanical controls. The student is expected to:

(A) explain how to operate and maintain heating, cooling, and ventilation systems in a greenhouse;

(B) explain how to operate and maintain electrical systems in a greenhouse; and

(C) explain how to operate and maintain various water systems in a greenhouse.

(7) The student propagates greenhouse crops. The student is expected to:

(A) analyze different methods of propagating greenhouse crops using sexual and asexual propagation methods;

(B) propagate greenhouse crops using various methods such as using seeds, seedlings, plugs, cuttings, and tissue culture; and

(C) investigate physiological conditions that affect plant propagation such as seed dormancy and root initiation.

(8) The student identifies and investigates greenhouse crop production factors. The student is expected to:

(A) explain and demonstrate the chemical and physical differences in greenhouse media components;

(B) compare greenhouse growing mixes for factors such as drainage and nutrient-holding capacity;

(C) compare and contrast different containers, benches, and other production equipment used in greenhouse crop production;

(D) evaluate different methods of watering greenhouse crops;

(E) analyze the effect of nutrients on greenhouse plant growth;

(F) diagnose common nutrient deficiency symptoms found in greenhouse crops; and

(G) develop fertilization plans that address greenhouse crop needs and environmental impacts.

(9) The student investigates pest identification and control methods in the greenhouse environment. The student is expected to:

(A) assess insect, pathogen, and weed infestations in a greenhouse;

(B) implement Integrated Pest Management in controlling an insect, pathogen, or weed problem;

(C) use appropriate greenhouse pesticide application techniques and equipment;

(D) research chemicals used to regulate plant growth in the greenhouse; and

(E) examine pesticide labeling and safety data sheets.

(10) The student performs greenhouse management business procedures. The student is expected to:

(A) market greenhouse crops;

(B) transport greenhouse crops;

(C) analyze materials, labor, and administrative costs related to greenhouse production;

(D) analyze methods used to maintain crop quality during marketing and transport; and

(E) prepare a production schedule for a greenhouse crop.

§130.25. Advanced Plant and Soil Science (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: a minimum of one credit from the courses in the Agriculture, Food, and Natural Resources Career Cluster. Recommended prerequisites: Biology, Integrated Physics and Chemistry (IPC), Chemistry, or Physics. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Advanced Plant and Soil Science provides a way of learning about the natural world. Students should know how plant and soil science has influenced a vast body of knowledge, that there are still applications to be discovered, and that plant and soil science is the basis for many other fields of science. To prepare for careers in plant and soil science, students must attain academic skills and knowledge, acquire technical knowledge and skills related to plant and soil science and the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not scientifically testable.

(5) Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.

(6) Scientific decision making is a way of answering questions about the natural world. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(8) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(9) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of plant systems;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation in plant systems;

(C) demonstrate knowledge of personal and occupational safety practices in the workplace;

(D) identify employer expectations and appropriate work habits; and

(E) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership.

(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:

(A) demonstrate safe practices during field and laboratory investigations; and

(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:

(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(4) of this section;

(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories;

(C) know scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well-established and highly-reliable explanations, but they may be subject to change as new areas of science and new technologies are developed;

(D) distinguish between scientific hypotheses and scientific theories;

(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micropipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(G) analyze, evaluate, make inferences, and predict trends from data; and

(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

(4) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) evaluate the impact of scientific research on society and the environment;

(E) evaluate models according to their limitations in representing biological objects or events; and

(F) research and describe the history of biology and contributions of scientists.

(5) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(6) The student analyzes plant and soil science as it relates to plant and soil relationships affecting the production of food, fiber, and other economic crops. The student is expected to:

(A) explain the importance and interrelationship of soil and plants; and

(B) practice soil and plant evaluation as it applies to agricultural and urban settings.

(7) The student develops scenarios for advances in plant and soil science. The student is expected to:

(A) design, conduct, and complete research in a laboratory or field investigation to solve problems in plant and soil science;

(B) use charts, tables, and graphs to prepare written summaries of results and data obtained in a laboratory or field investigation;

(C) organize, analyze, evaluate, make inferences, and predict trends from data obtained in a laboratory or field investigation; and

(D) communicate valid outcomes and solutions.

(8) The student explains the relationship of biotic and abiotic factors within habitats and ecosystems. The student is expected to:

(A) identify native and introduced plants, assess their role in an ecosystem, and compare them to plants in other ecosystems;

(B) make observations and compile data about fluctuations in abiotic cycles and evaluate their effects on local ecosystems;

(C) evaluate the impact of human activity such as pest control, hydroponics, and sustainable agriculture on ecosystems; and

(D) predict how the introduction, removal, or re-introduction of an organism may affect the food chain and existing populations.

(9) The student analyzes soil science as it relates to food and fiber production. The student is expected to:

(A) explain soil formation;

(B) evaluate the properties and nature of soils;

(C) recognize the importance of conservation of soil and agencies involved in conservation;

(D) recognize the application of soil mechanics to engineering and excavation operations;

(E) perform soil management practices such as tillage trials and sustainable soil management practices; and

(F) practice soil evaluations related to experiential activities such as land judging.

(10) The student describes the relationship between resources within environmental systems. The student is expected to:

(A) summarize methods of land use and management;

(B) identify sources, use, quality, and conservation of water;

(C) explore the use and conservation of renewable and non-renewable resources;

(D) analyze and evaluate the economic significance and interdependence of components of the environment;

(E) evaluate the impact of human activity and technology on soil fertility and productivity;

(F) analyze and describe the effects on environments of events such as fire, hurricanes, deforestation, mining, population growth, and urban development; and

(G) explain how regional changes in the environment may have a global effect.

(11) The student describes the origin and use of water in a watershed. The student is expected to:

(A) identify sources and calculate the amount of water in a watershed, including ground and surface water;

(B) research and identify the type of water used in a watershed;

(C) analyze water quality in a watershed; and

(D) identify and use methods to evaluate water quantity available in a watershed.

(12) The student maps the process of soil formation influenced by weathering, including erosion processes due to water, wind, and mechanical factors influenced by climate. The student is expected to:

(A) illustrate the role of weathering in soil formations;

(B) distinguish chemical weathering from mechanical weathering; and

(C) identify geological formations that result from differing weathering processes.

(13) The student describes the dynamics of a watershed. The student is expected to:

(A) identify the characteristics of a local watershed such as average annual rainfall, runoff patterns, aquifers, location of water basins, and surface reservoirs; and

(B) analyze the impact of floods, drought, irrigation, urbanization, and industrialization in a watershed.

(14) The student explains how petroleum energy resources affect agriculture. The student is expected to:

(A) research and describe the origin of fossil fuels such as coal, oil, and natural gas;

(B) analyze issues regarding the use of fossil fuels and other non-renewable energy sources or alternative energy sources; and

(C) analyze the significance and economic impact of the use of fossil fuels and alternative energy sources.

(15) The student evaluates components of plant science as they relate to crop production. The student is expected to:

(A) analyze plant physiology, genetics, and reproduction of various crops;

(B) recognize characteristics related to seed quality such as mechanical damage, viability, and grade;

(C) identify plant pests and diseases and their causes, prevention, and treatment;

(D) perform plant management practices such as germination tests, plant spacing trials, and fertilizer tests; and

(E) measure trends in crop species and varieties grown locally in Texas and the United States and how they affect agriculture and consumers.

(16) The student identifies how plants grow and how specialized cells, tissues, and organs develop. The student is expected to:

(A) compare cells from different parts of the plant, including roots, stems, and leaves, to show specialization of structures and functions; and

(B) sequence the levels of organization in multicellular organisms that relate the parts to each other and the whole.

(17) The student diagrams the structure and function of nucleic acids in the mechanism of genetics. The student is expected to:

(A) describe components of deoxyribonucleic acid (DNA) and illustrate how information for specifying the traits of an organism is carried in DNA;

(B) identify and illustrate how changes in DNA cause phenotypic or genotypic changes;

(C) compare and contrast genetic variations observed in plants and animals; and

(D) compare the processes of mitosis and meiosis and their significance.

(18) The student demonstrates skills related to the human, scientific, and technological dimensions of crop production and the resources necessary for producing domesticated plants. The student is expected to:

(A) describe the growth and development of major crops;

(B) apply principles of genetics and plant breeding;

(C) examine the development of crop varieties through the origin of agriculture; and

(D) design and conduct experiments to support known principles of genetics.

(19) The student explains the chemistry involved in plants at the cellular level. The student is expected to:

(A) compare the structures and functions of different types of organic molecules such as carbohydrates, lipids, proteins, and nucleic acids;

(B) compare the energy flow in photosynthesis to the energy flow in cellular respiration; and

(C) investigate and identify the effect of enzymes on plant cells.

(20) The student identifies the sources and flow of energy through environmental systems. The student is expected to:

(A) summarize forms and sources of energy;

(B) explain the flow of energy in an environment;

(C) investigate and explain the effects of energy transformations in an ecosystem; and

(D) investigate and identify energy interaction in an ecosystem.

§130.26. Agricultural Mechanics and Metal Technologies (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Agriculture, Food, and Natural Resources. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Agricultural Mechanics and Metal Technologies is designed to develop an understanding of agricultural mechanics as it relates to safety and skills in tool operation, electrical wiring, plumbing, carpentry, fencing, concrete, and metal working techniques. To prepare for careers in agricultural power, structural, and technical systems, students must attain academic skills and knowledge; acquire technical knowledge and skills related to power, structural, and technical agricultural systems and the industry; and develop knowledge and skills regarding career opportunities, entry requirements, industry certifications, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of power, structural, and technical agricultural systems;

(B) apply competencies related to resources, information, interpersonal skills, problem solving, critical thinking, and systems of operation of power, structural, and technical agricultural systems;

(C) examine licensing, certification, and credentialing requirements to maintain compliance with industry requirements;

(D) demonstrate knowledge of personal and occupational health, safety, and first-aid practices in the industry;

(E) identify employer expectations and appropriate work habits; and

(F) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student follows operating instructions for tools and equipment to perform a given task. The student is expected to:

(A) select, use, maintain, and store appropriate hand tools to perform a given task;

(B) select, use, maintain, and store appropriate power equipment such as tools powered by electric, pneumatic, and internal combustion engines; and

(C) select and use measuring and marking devices.

(4) The student identifies and performs electric wiring skills. The student is expected to:

(A) identify principles of electricity and wiring terminology;

(B) install electric wiring components and fixtures to comply with governmental regulations and applicable codes; and

(C) maintain electric motors.

(5) The student performs plumbing skills. The student is expected to:

(A) identify and use plumbing tools; and

(B) identify plumbing fixtures.

(6) The student performs concrete construction skills. The student is expected to:

(A) project cost estimates for materials; and

(B) form and pour concrete slabs.

(7) The student performs carpentry skills. The student is expected to:

(A) identify materials used in agricultural construction;

(B) identify elements of a cost estimate and prepare a bid package for a planned project;

(C) demonstrate basic carpentry skills; and

(D) paint and protect a project with coatings.

(8) The student identifies fencing methods. The student is expected to:

(A) select fencing materials; and

(B) plan and install fences.

(9) The student performs appropriate cold and hot metal techniques. The student is expected to:

(A) identify types of metal;

(B) cut, file, shape, and drill metal;

(C) select and operate oxy-fuel welding and cutting equipment to meet standards;

(D) select and operate electric-arc welding equipment to meet standards; and

(E) perform specialty welding and cutting techniques to meet standards.

(10) The student applies processes relating to assembly of equipment in agricultural systems operations. The student is expected to:

(A) select, use, and maintain appropriate tools, equipment, and facilities; and

(B) identify and determine properties, types, and uses of metal.

(11) The student plans and performs cost-effective construction techniques. The student is expected to:

(A) analyze site, equipment, and permit requirements;

(B) operate computer-aided drafting design software;

(C) develop, read, and interpret designs and sketches;

(D) estimate material needs and costs;

(E) measure, mark, and cut material; and

(F) perform specialized nonmetallic fabrication techniques.

§130.27. Agricultural Structures Design and Fabrication (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Recommended prerequisite: Agricultural Mechanics and Metal Technologies. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Agricultural Structures Design and Fabrication, students will explore career opportunities, entry requirements, and industry expectations. To prepare for careers in mechanized agriculture and technical systems, students must attain knowledge and skills related to agricultural structures design and fabrication. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their academic knowledge and technical skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of mechanized agriculture;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation of mechanized agriculture;

(C) research licensing, certification, and credentialing requirements;

(D) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(E) identify employer expectations and appropriate work habits; and

(F) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student demonstrates principles of facilities design and fabrication related to agricultural structures. The student is expected to:

(A) develop building plans;

(B) select site and locate agricultural building placement;

(C) estimate materials and costs needed for construction with an emphasis on renewable and eco-friendly materials;

(D) select appropriate environmental control systems with a special emphasis on green technology; and

(E) use computer-aided design software as appropriate.

(4) The student explores the different types of power systems used in agricultural structures. The student is expected to:

(A) define the terms and principles of electricity;

(B) estimate electrical needs and loads;

(C) plan installations using local codes and National Electric Code guidelines;

(D) demonstrate the use of various meters;

(E) select circuit wiring materials and supplies;

(F) demonstrate electrical systems repair; and

(G) explore alternative power systems, including solar, wind, and biomass.

(5) The student constructs agricultural structures using appropriate technology. The student is expected to:

(A) demonstrate appropriate use of surveying equipment;

(B) demonstrate and apply Geographic Information System (GIS) and Global Positioning System (GPS) principles;

(C) reinforce, place, finish, and cure concrete;

(D) plan, establish, and maintain water-management systems;

(E) identify non-traditional structural building techniques, including industry trends that are eco-friendly;

(F) discuss the use of masonry and drywall construction;

(G) install doors, windows, and roofing materials; and

(H) install plumbing equipment and fixtures to comply with governmental regulations and applicable codes.

(6) The student demonstrates metal construction techniques related to agricultural design and fabrication of structures. The student is expected to:

(A) explain the operations of safe oxy-fuel cutting; and

(B) demonstrate safe electrical welding.

§130.28. Agricultural Equipment Design and Fabrication (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Recommended prerequisite: Agricultural Mechanics and Metal Technologies. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) In Agricultural Equipment Design and Fabrication, students will acquire knowledge and skills related to the design and fabrication of agricultural equipment. To prepare for careers in mechanized agriculture and technical systems, students must attain knowledge and skills related to agricultural equipment design and fabrication. To prepare for success, students reinforce, apply, and transfer their academic knowledge and technical skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of mechanized agriculture;

(B) apply competencies related to resources, information, interpersonal skills, and systems of operation of mechanized agriculture;

(C) research licensing, certification, and credentialing requirements;

(D) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(E) identify employer expectations and appropriate work habits; and

(F) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student demonstrates principles of design and fabrication related to agricultural machinery and equipment. The student is expected to:

(A) develop project construction plans;

(B) select appropriate construction and finish materials for different types of agricultural equipment;

(C) estimate materials and costs needed for construction with an emphasis on renewable and eco-friendly materials;

(D) construct one or more agricultural equipment projects using measuring and mechanical skills;

(E) integrate a logical order of operations into the construction of an agricultural equipment project; and

(F) use computer-aided design software.

(4) The student plans, constructs, and maintains fences, corrals, and other agricultural enclosures. The student is expected to:

(A) select site and locate enclosures;

(B) estimate materials and building costs; and

(C) define appropriate construction methods that are friendly to the environment.

(5) The student demonstrates construction techniques related to design and fabrication of agricultural equipment. The student is expected to:

(A) operate oxy-fuel and plasma cutting equipment safely;

(B) proficiently demonstrate safe electrical welding; and

(C) use hand and power tools in the construction and repair of agricultural equipment safely.

(6) The student demonstrates knowledge of laws and regulations related to the construction, design and fabrication of agricultural equipment. The student is expected to:

(A) incorporate industry standards developed by entities such as American National Standards Institute (ANSI), American Society of Agricultural Engineers (ASAE), or Occupational Safety and Health Administration (OSHA) into the construction of agricultural equipment; and

(B) design and build equipment in compliance with state and federal laws enforced by agencies such as the U.S. Department of Transportation (DOT).

§130.29. Agricultural Power Systems (Two Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisite: Principles of Agriculture, Food, and Natural Resources. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Agricultural Power Systems is designed to develop an understanding of power and control systems as related to energy sources, small and large power systems, and agricultural machinery. To prepare for careers in agricultural power, structural, and technical systems, students must attain academic skills and knowledge; acquire technical knowledge and skills related to power, structural, and technical agricultural systems and the workplace; and develop knowledge and skills regarding career opportunities, entry requirements, industry certifications, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and technical skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) identify career development and entrepreneurship opportunities in the field of power, structural, and technical systems;

(B) apply competencies related to resources, information, interpersonal skills, problem solving, and critical thinking in power, structural, and technical systems;

(C) examine licensing, certification, and credentialing requirements to maintain compliance with industry requirements;

(D) demonstrate knowledge of personal and occupational health and safety practices in the workplace;

(E) identify employers' expectations and appropriate work habits; and

(F) demonstrate characteristics of good citizenship, including advocacy, stewardship, and community leadership.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student connects power generation to differing energy sources. The student is expected to:

(A) examine benefits and detriments of petroleum and alternative energy sources;

(B) compare environmental impacts of varying energy sources;

(C) compare efficiency and characteristics of different energy sources; and

(D) investigate the efficiency of power generation systems that use various energy sources.

(4) The student selects the appropriate tool to perform a given task related to agricultural power systems. The student is expected to:

(A) select and identify standard tools, equipment, and safety procedures common to power and control applications;

(B) follow operating instructions of specialized tools and equipment such as micrometers, digital multimeters, and dynamometers;

(C) set up and adjust tools and equipment such as dynamometers, flow meters, torque wrenches, lathes, and mills;

(D) maintain and store tools and equipment common to power and control applications; and

(E) inventory tools and equipment in a service or maintenance facility.

(5) The student selects, operates, and maintains small engines. The student is expected to:

(A) describe principles of operation of internal combustion engines;

(B) disassemble and reassemble small engines;

(C) select, maintain, and troubleshoot small engines; and

(D) research small engine industry certifications.

(6) The student selects, operates, and maintains agricultural machines and equipment. The student is expected to:

(A) identify and select agricultural equipment for appropriate tasks such as the selection of tillage equipment to obtain a desired result;

(B) identify and maintain component materials such as bearings, hydraulic cylinders, seals, chains, and drives on varying types of machines and equipment;

(C) ensure the presence and function of safety devices such as guards and shields and hardware on machinery and equipment;

(D) calibrate metering, monitoring, and sensing equipment on various equipment such as tillage, harvest, transport, and haying equipment; and

(E) perform pre-operation inspection and appropriate start-up procedures, identify causes of equipment malfunctions and failures, perform scheduled preventive maintenance, and safely operate equipment.

(7) The student selects, operates, and maintains tractors and agricultural power systems. The student is expected to:

(A) select tractors based upon application and power requirements and describe or perform safe operation of tractors in various applications;

(B) maintain intake and exhaust system components, including shrouds, screens, filters, piping, after-coolers, air induction systems, manifolds, exhaust scrubbers, and mufflers;

(C) select lubricants and apply appropriate lubrication as required by maintenance schedules;

(D) identify and maintain various fuel systems, power trains, and hydraulic systems used on farm tractors;

(E) explain charging, starting, operating, and igniting direct current electrical systems;

(F) maintain steering and braking systems;

(G) maintain tires and tracks and describe the role of ballasting and traction in farm tractors; and

(H) explain the operation of and maintain liquid- and air-cooling systems in tractors.

(8) The student monitors and controls electrical systems as related to agricultural machines and equipment. The student is expected to:

(A) collect data and troubleshoot electrical systems using various meters and test equipment such as digital multimeters;

(B) employ appropriate techniques for applying devices, controls, and grounding in electrical systems;

(C) apply local and national codes and regulations relevant in electrical systems;

(D) select and apply electric controls such as motor controls, switches, circuit breakers, timers, sensors, and relays; and

(E) interpret data generated by electrical monitoring systems.

(9) The student implements control systems related to agricultural machines and equipment. The student is expected to:

(A) analyze schematic drawings for electrical control systems;

(B) describe uses of various electrical control system components;

(C) install control system components such as motor controls, switches, circuit breakers, timers, sensors, and relays and properly use appropriate tools, procedures, and safety practices; and

(D) identify system performance problems and apply troubleshooting techniques using monitoring or troubleshooting devices.

(10) The student describes hydraulic controls and applications as related to agricultural machines and equipment. The student is expected to:

(A) describe the operation of open and closed center hydraulic systems;

(B) explain the purpose and function of hydraulic controls such as valves, motors, pumps, cylinders, manifolds, and meters; and

(C) create basic hydraulic circuits using a variety of hydraulic controls.

(11) The student describes additional control systems as related to agricultural machines and equipment. The student is expected to:

(A) explain the application of pneumatic systems and controls; and

(B) explain the application of water or other fluid control systems to agricultural machines and equipment and their components.

§130.30. Agricultural Laboratory and Field Experience (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. The Agriculture Laboratory and Field Experience course is an enhancement opportunity for students participating in a coherent sequence of career and technical education courses in the Agriculture, Food, and Natural Resources Career Cluster; it may be paid or unpaid. This course must be taken concurrently with another relevant course from the Agriculture, Food, and Natural Resources Career Cluster and may not be taken as a stand-alone course. Prerequisite: a minimum of one credit from the courses in the Agriculture, Food, and Natural Resources Career Cluster. Corequisite: any course in the Agriculture, Food, and Natural Resources Career Cluster, excluding Principles of Agriculture, Food, and Natural Resources. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Agriculture Laboratory and Field Experience is designed to provide students a laboratory and/or field experience opportunity. To prepare for careers in agriculture, food, and natural resources, students must acquire knowledge and skills that meet entry requirements and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer academic knowledge and technical skills in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) investigate career development and entrepreneurship opportunities in agriculture, food, and natural resources;

(B) apply competencies related to resources, information, and interpersonal skills;

(C) practice personal and occupational health and safety practices in the workplace;

(D) examine employer expectations and exhibit appropriate work habits;

(E) develop good characteristics of citizenship, including advocacy, stewardship, and community leadership; and

(F) pursue appropriate licensing, certification, and credentialing requirements.

(2) The student uses technology to research a project. The student is expected to:

(A) effectively use search engines, databases, and other digital electronic tools to locate information;

(B) evaluate quality, accuracy, completeness, reliability, and currency of information from any source;

(C) prepare, organize, present, and apply independent research; and

(D) accept constructive criticism and revise personal views when warranted by valid evidence.

(3) The student develops an elevated aptitude for the essential knowledge and skills listed for the corequisite course. The student is expected to:

(A) demonstrate deeper understanding of the corequisite course;

(B) develop mastery of hands-on skills at an industry-accepted standard; and

(C) exhibit progress toward achieving industry-recognized documentation of specific expertise in an agriculture, food, and natural resources field or skill.

§130.31. Practicum in Agriculture, Food, and Natural Resources (Two to Three Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Agriculture, Food, and Natural Resources Career Cluster. Recommended prerequisite: a minimum of one credit from the courses in the Agriculture, Food, and Natural Resources Career Cluster.

(1) A student shall be awarded two credits for successful completion of this course, when the student participates in at least an average of 10 hours, but less than 15 hours, per week of a paid or unpaid, laboratory- or work-based application of previously studied knowledge and skills related to the Agriculture, Food, and Natural Resources Career Cluster.

(2) A student shall be awarded three credits for successful completion of this course, when the student participates in an average of 15 hours per week of a paid or unpaid, laboratory- or work-based application of previously studied knowledge and skills related to the Agriculture, Food, and Natural Resources Career Cluster.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Agriculture, Food, and Natural Resources Career Cluster focuses on the production, processing, marketing, distribution, financing, and development of agricultural commodities and resources, including food, fiber, wood products, natural resources, horticulture, and other plant and animal products/resources.

(3) Practicum in Agriculture, Food, and Natural Resources is designed to give students supervised practical application of knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experiences such as employment, independent study, internships, assistantships, mentorships, or laboratories. To prepare for careers in agriculture, food and natural resources, students must attain academic skills and knowledge, acquire technical knowledge and skills related to the workplace, and develop knowledge and skills regarding career opportunities, entry requirements, and industry expectations. To prepare for success, students need opportunities to learn, reinforce, apply, and transfer their knowledge and skills and technologies in a variety of settings.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to:

(A) adhere to policies and procedures;

(B) demonstrate positive work behaviors and attitudes, including punctuality, time management, initiative, and cooperation;

(C) apply constructive criticism and critical feedback from supervisor and peers;

(D) apply ethical reasoning to a variety of situations in order to make ethical decisions;

(E) complete tasks with high standards to ensure quality products and services;

(F) model professional appearance, including using appropriate dress, grooming, and personal protective equipment as appropriate; and

(G) comply with practicum setting safety rules and regulations to maintain safe and healthful working conditions and environments.

(2) The student develops a supervised agriculture experience program. The student is expected to:

(A) plan, propose, conduct, document, and evaluate a supervised agriculture experience program as an experiential learning activity;

(B) apply proper record-keeping skills as they relate to the supervised agriculture experience;

(C) participate in youth leadership opportunities to create a well-rounded experience program; and

(D) produce and participate in a local program of activities using a strategic planning process.

(3) The student applies concepts of critical thinking and problem solving. The student is expected to:

(A) analyze elements of a problem to develop creative and innovative solutions;

(B) analyze information to determine value to the problem-solving task;

(C) compare and contrast alternatives using a variety of problem-solving and critical-thinking skills; and

(D) conduct technical research to gather information necessary for decision making.

(4) The student demonstrates leadership and teamwork skills to accomplish goals and objectives. The student is expected to:

(A) analyze leadership characteristics in relation to trust, positive attitude, integrity, and willingness to accept key responsibilities in a work situation;

(B) demonstrate teamwork skills through working cooperatively with others to achieve tasks;

(C) demonstrate teamwork processes that promote team-building, consensus, continuous improvement, respect for the opinions of others, cooperation, adaptability, and conflict resolution;

(D) demonstrate responsibility for shared group and individual work tasks;

(E) establish and maintain effective working relationships in order to accomplish objectives and tasks;

(F) demonstrate effective working relationships using interpersonal skills in order to accomplish objectives and tasks;

(G) negotiate and work cooperatively with others using positive interpersonal skills; and

(H) demonstrate respect for individuals, including those from different cultures, genders, and backgrounds, and value for diversity.

(5) The student demonstrates oral and written communication skills in creating, expressing, and interpreting information and ideas, including technical terminology and information. The student is expected to:

(A) apply appropriate content knowledge, technical concepts, and vocabulary when analyzing information and following directions;

(B) employ verbal skills when obtaining and conveying information;

(C) review, use, and apply informational texts, Internet sites, or technical materials for occupational tasks;

(D) evaluate the reliability of information from informational texts, Internet sites, or technical materials and resources;

(E) interpret verbal and nonverbal cues and behaviors to enhance communication;

(F) apply active listening skills to obtain and clarify information; and

(G) facilitate effective written and oral communication using academic skills.

(6) The student develops management skills for agricultural resources. The student is expected to:

(A) discuss the importance of agricultural and natural resources to individuals and society;

(B) develop long-range land, water, and air quality management plans;

(C) practice equipment maintenance procedures;

(D) analyze the cost and maintenance of tools, equipment, and structures used in agriculture;

(E) describe and develop marketing strategies for agricultural and natural resources;

(F) decide between replacement, maintenance, repair, and reconditioning of agricultural vehicles and machinery; and

(G) describe and perform hazard analysis and follow safety laws.

(7) The student demonstrates technical knowledge and skills required to pursue a career in the Agriculture, Food, and Natural Resources Career Cluster. The student is expected to:

(A) develop advanced technical knowledge and skills related to the personal occupational objective;

(B) evaluate strengths and weaknesses in technical skill proficiency;

(C) explain the principles of safe operation of tools and equipment related to the practicum; and

(D) pursue opportunities for licensure or certification related to chosen career path.

(8) The student documents technical knowledge and skills. The student is expected to:

(A) create a professional portfolio to include:

(i) attainment of technical skill competencies;

(ii) licensures or certifications;

(iii) recognitions, awards, and scholarships;

(iv) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;

(v) abstract of key points of the practicum;

(vi) resume;

(vii) samples of work; and

(viii) evaluation from the practicum supervisor; and

(B) present the portfolio to interested stakeholders.