

FY 2016 Agricultural and Environmental Systems Career Field Pathways and Course Structure

Criteria for Course/Model Development

1. Courses are designed to attract student enrollment.
2. There are no courses labeled as “Intro To” or “Principles of.” There are no exploratory courses and all offer concrete knowledge and skills based on the A&E Systems Content Standards.
3. The Courses are designed to fit in a comprehensive middle and high school model typically offering 40-50 minutes per day (120-150 hours/year) as well as a career center model typically offering 120-150 minutes per day (360-450 hours/year).
4. There are no prerequisite course requirements.
5. Agriculture, Food and Natural Resources (010105) is the first course in each Career Field. It is designed for middle school students in addition to freshman and is designated in the chart with ⁽¹⁾.
6. Course structure must facilitate testing using CTE Technical tests.
7. Each Pathway has a “first course in the pathway” ⁽²⁾.
8. The Agriculture, Food and Natural Resources course and the first course in each pathway are designed for middle school students in addition to freshman and sophomores.
9. Pathway course structure should align with postsecondary programs for enhancing successful articulation.
10. All courses will have a 120-hour minimum and a 280-hour maximum.
11. Programs must be comprised of a minimum of four courses from the pathway courses. Additional courses can come from the pathway. The Capstone course must be taught in addition to the four course minimum. There is no maximum on the number of courses.

Assessment Considerations

1. Assessments will be developed for every course except the Capstone course.
2. Since instructional time is considered to be integral to test module development, it is assumed that ~15% of every course is devoted to Business Operations.

Program of Study Requirements

1. All programs currently approved as meeting Tech Prep requirements will be expected to renew program application materials in FY17.

Tech Prep Program Standards

1. CTE-26 Application, Program of Study, and Assurances must be approved.
2. Coursework includes articulated credit that is directly related to the secondary/postsecondary Career Field. Postsecondary credit will be transcribed no later than the conclusion of the term in which the student has met the postsecondary residency requirements.
3. Program of Study provides educational experiences to prepare the student for state or industry recognized assessment and the appropriate state technical competency assessment.
4. College ready assessments (Compass, Asset, ACT) must be accessible to all students.

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Agribusiness & Production Systems A0 Pathway Courses	Industrial Power Technology A1 Pathway Courses	Animal Science & Management A2 Pathway Courses	Agriculture, Food, and Natural Resources Bioscience A3 Pathway Courses	Horticulture A5 Pathway Courses	Natural Resource Management A6 Pathway Courses
Agriculture, Food and Natural Resources ¹	Agriculture, Food and Natural Resources ¹	Agriculture, Food and Natural Resources ¹	Agriculture, Food and Natural Resources ¹	Agriculture, Food and Natural Resources ¹	Agriculture, Food and Natural Resources ¹
Animal and Plant Science ^{2,3}	Ag & Industrial Power ²	Animal Science and Technology ²	Science & Technology of Food ²	Plant and Horticultural Science ²	Natural Resources ²
Mechanical Principles ⁴	Electronic & Electrical Systems	Animal Anatomy and Physiology ³	Animal and Plant Biotechnology ²	Floral Design and Marketing	Energy Systems Management
Science & Technology of Food	Engines and Fuel Systems	Animal Health ⁴	Food Marketing and Research	Greenhouse and Nursery Management	Environmental Science for Agriculture and Natural Resources
Animal and Plant Biotechnology ²	Hydraulics and Pneumatics	Medical Terminology	Meat Science and Technology	Landscape Design ⁴	Environmental Systems Management
Greenhouse & Nursery Management	Outdoor Power Technology	Companion Animal Selection, Nutrition, & Mgt ⁴	Genetics of Plants and Animals ⁴	Landscape Hardscapes ³	Forestry & Woodland Ecosystems
Forestry & Woodland Ecosystems	Power Sports	Livestock Selection, Nutrition, & Mgt ⁴	Principles and Practices of Bioscience ⁴	Landscape Systems Management	Park & Recreational Management
Agronomic Systems	Power Trains	Equine Selection, Nutrition, & Mgt ⁴	Applications of Food Science and Safety ⁴	Turf Science & Management	Urban Forestry
Business Management for Agricultural and Environmental Systems	Business Management for Agricultural and Environmental Systems	Zoo and Aquarium	Bioresearch ⁴	Urban Forestry	Wildlife & Fisheries
Global Economics and Food Markets	A&E Capstone	Veterinary Science	Environmental Science for Agriculture and Natural Resources	Park & Recreational Management	Oil and Gas Operations ⁴
Animal Anatomy and Physiology ³		Meat Science and Technology	Business Management for Agricultural and Environmental Systems	Business Management for Agricultural and Environmental Systems	Bio Energy
Animal Health ⁴		Plant and Horticultural Science	A&E Capstone	A&E Capstone	Solar and Wind Energy
Livestock Selection, Nutrition, & Mgt ⁴		Environmental Science for Agriculture and Natural Resources			Electronic and Electrical Systems
Meat Science and Technology		Business Management for Agricultural and Environmental Systems			Hydraulics and Pneumatics
Energy Systems Management		A&E Capstone			Business Management for Agricultural and Environmental Systems
Environmental Science for Agriculture and Natural Resources					A&E Capstone
A&E Capstone					

¹First course in the Career Field; ²First course in the Pathway; ³New Course; ⁴Modification to Existing Course

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Agricultural and Environmental Systems Career Field Pathways and Courses

Courses in Agribusiness & Production Systems (A0)

PATHWAY COURSES	SUBJECT CODE
Agriculture, Food and Natural Resources ¹	010105
Animal and Plant Science ^{2,3}	010125
Mechanical Principles ⁴	010120
Science & Technology of Food	011010
Animal and Plant Biotechnology ²	012010
Greenhouse and Nursery Management	010610
Forestry and Woodland Ecosystems	010730
Agronomic Systems	010620
Business Management for Agricultural and Environmental Systems	010115
Global Economics and Food Markets ³	010130
Animal Anatomy and Physiology ³	010945
Animal Health ⁴	010915
Livestock Selection, Nutrition and Management ⁴	010920
Meat Science and Technology	011020
Energy Systems Management	010715
Environmental Science for Agriculture and Natural Resources	010720
Agricultural and Environmental Systems Capstone	010190

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Courses in Industrial Power Technology (A1)

PATHWAY COURSES	SUBJECT CODE
Agriculture, Food and Natural Resources ¹	010105
Agricultural & Industrial Power ²	010210
Electronic & Electrical Systems	010215
Engines and Fuel Systems	010220
Hydraulics and Pneumatics	010225
Outdoor Power Technology	010235
Power Sports	010240
Power Trains	010230
Business Management for Agricultural and Environmental Systems	010115
Agricultural and Environmental Systems Capstone	010190

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Courses in Animal Science & Management (A2)

PATHWAY COURSES	SUBJECT CODE
Agriculture, Food and Natural Resources ¹	010105
Animal Science and Technology ²	010910
Animal Anatomy and Physiology ³	010945
Animal Health ⁴	010915
Medical Terminology	072150
Companion Animal Selection, Nutrition and Management ⁴	010925
Livestock Selection, Nutrition and Management ⁴	010920
Equine Selection, Nutrition and Management ⁴	010935
Zoo and Aquarium	010940
Veterinary Science	010930
Meat Science and Technology	011020
Plant and Horticulture Science	010155
Environmental Science for Agriculture and Natural Resources	010720
Business Management for Agricultural and Environmental Systems	010115
Agricultural and Environmental Systems Capstone	010190

¹First course in the Career Field; ²First course in the Pathway; ³New Course; ⁴Modification to Existing Course

(NEW) Pathway in Agriculture, Food and Natural Resources Bioscience (A3)

PATHWAY COURSES	SUBJECT CODE
Agriculture, Food and Natural Resources ¹	010105
Science & Technology of Food ²	011010
Animal and Plant Biotechnology ²	012010
Food Marketing and Research	011015
Meat Science and Technology	011020
Genetics of Plants and Animals	012020
Principles and Practices of Bioscience	012015
Applications of Food Science and Safety ⁴	011030
Bioresearch	012025
Environmental Science for Agriculture and Natural Resources	010720
Business Management for Agricultural and Environmental Systems	010115
Agricultural and Environmental Systems Capstone	010190

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Courses in Horticulture (A5)

PATHWAY COURSES	SUBJECT CODE
Agriculture, Food and Natural Resources ¹	010105
Plant and Horticultural Science ²	010155
Floral Design and Marketing	010625
Greenhouse and Nursery Management	010610
Landscape Design ⁴	010630
Landscape Hardscapes ³	010640
Landscape Systems Management	010615
Turf Science & Management	010635
Urban Forestry	010740
Park & Recreational Management	010735
Business Management for Agricultural and Environmental Systems	010115
Agricultural and Environmental Systems Capstone	010190

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Courses in Natural Resource Management (A6)

PATHWAY COURSES	SUBJECT CODE
Agriculture, Food and Natural Resources ¹	010105
Natural Resources ²	010710
Energy Systems Management	010715
Environmental Science for Agriculture and Natural Resources	010720
Environmental Systems Management	010725
Forestry and Woodland Ecosystems	010730
Park & Recreational Management	010735
Urban Forestry	010740
Wildlife & Fisheries	010745
Oil and Gas Operations ⁴	010718
Bio Energy	010716
Solar and Wind Energy	010717
Electronic & Electrical Systems	010215
Hydraulics and Pneumatics	010225
Business Management for Agricultural and Environmental Systems	010115
Agricultural and Environmental Systems Capstone	010190

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Agricultural and Environmental Systems Course Descriptions

Agriculture, Food and Natural Resources

Subject Code: 010105

This first course in the career field is an introduction to Agricultural and Environmental Systems. Students will be introduced to the scope of the Agricultural and Environmental Systems career field. They will examine principles of food science, natural resource management, animal science & management, plant & horticultural science, power technology and bioscience. Students will examine the FFA organization and Supervised Agricultural Experience programs. Throughout the course, students will develop communication, leadership and business skills essential to the agriculture industry.

Animal and Plant Science

Subject Code: 010125

Students will apply knowledge of animal and plant science to the agriculture industry. They will be introduced to the value of production animals relative to the agricultural marketplace. Students will engage in animal classification and selection, body systems, along with animal welfare and behavior in relation to the production of animals. Students will learn principles of plant anatomy and physiology, and the role of nutrition, deficiencies and growing environment on plant production. Throughout the course, business principles and professional skills will be examined.

Mechanical Principles

Subject Code: 010120

Students will engage in the mechanical principles utilized in animal and plant production systems. They will learn electrical theory, design, wiring, hydraulic and pneumatic theory, along with metallurgy in relation to hot and cold metals. Students will apply knowledge of sheet metal fabrication applicable to the agricultural industry along with identify, diagnose, and maintain small air-cooled engines. Throughout the course, students will learn critical components of site and personal safety as well as communication and leadership skills.

Agronomic Systems

Subject Code: 010620

Students will apply knowledge and skills required to research, develop, produce and market major agricultural and horticultural crops. Cultural and sustainable production practices will be examined while students apply scientific knowledge of plant development, nutrition and growth regulation. The knowledge and skills needed to manage water, soils, and pests related to agronomic crops will be assessed. Students will employ technological advances, communication, business, and management strategies appropriate for the industry.

Business Management for Agricultural and Environmental Systems

Subject Code: 010115

Students will examine elements of business, identify organizational structures and apply management skills while developing business plans, financial reports and strategic goals for new ventures or existing businesses. Learners will use marketing concepts to evaluate the marketing environment and develop a

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marketing plan with marketing channels, product approaches, promotion and pricing strategies. Throughout the course, students will apply concepts of ethics and professionalism while implications of business regulations will be identified.

Global Economics and Food Markets

Subject Code: 010130

Students will examine economic principles related to agriculture, food, and natural resources along with the operation and use of commodity futures and option markets. Students will learn economic principles with emphasis on their application to the solution of agricultural industry problems. They will examine future exchanges and commodity futures contracts, hedging strategies, as well as put and call options. Throughout the course, students will become familiar with the causes and consequences of economic growth, globalization and development.

Agricultural and Environmental Systems Capstone

Subject Code: 010190

Students apply Agricultural and Environmental Systems program knowledge and skills in a more comprehensive and authentic way. Capstones are project/problem-based learning opportunities that occur both in and away from school. Under supervision of the school and through partnerships, students combine classroom learning with work experience to benefit themselves and others. These can take the form of mentorship employment, cooperative education, apprenticeships and internships.

Agricultural and Industrial Power

Subject Code: 010210

In this first course, students will learn the breadth of the Agricultural and Industrial Power Technology pathway. Students will learn the principles of power technology equipment systems which will include electronic and electrical systems, engines and fuels, hydraulic systems and power train components. Additionally, students will learn to safely operate and maintain machinery and equipment along with the principles of welding and metal fabrication.

Electronic and Electrical Systems

Subject Code: 010215

Students will diagnose, test and repair the electronic and electrical components found in industrial power equipment. Students will learn the physical principles of electricity and apply this knowledge in the maintenance, diagnostics and repair of electrical and electronic systems. Students will learn the physical and mathematical principles of electronics, controllers and sensors and will learn the operation of onboard computers and programmable controllers. Site and personal safety along with business and employability skills are emphasized throughout the course.

Engines and Fuel Systems

Subject Code: 010220

Students will identify, diagnose, maintain and repair engines, including two and four-stroke, in addition to fueling systems based upon engine specifications. Topics include differentiation of fuels and fueling systems along with their characteristics, designations, and additives. Students will learn the principles of cooling, lubrication, intake and exhaust systems and how to make necessary repairs while maintaining system cleanliness. Throughout the course, site and personal safety along with business and employability skills are emphasized.

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Hydraulics and Pneumatics

Subject Code: 010225

Students will learn to diagnose, repair and rebuild hydraulic systems and their components. Students will learn the physical and mechanical principles of both hydraulic and hydrostatic operating units. Topics include testing system components and properly maintaining hydraulic and hydrostatic circuits. Students will demonstrate contamination control and system cleanliness in both hydraulic and hydrostatic operating systems. Throughout the course, site and personal safety procedures and business practices are reinforced.

Outdoor Power Technology

Subject Code: 010235

Students will perform technical skills needed to maintain, diagnose and repair outdoor power equipment. Students will learn the theory of power and examine the aspects of repairing various engines, drive trains, and ancillary systems that make up modern small engine powered equipment. In addition, students will develop troubleshooting skills for 2- and 4-stroke engines, electrical and fuel systems. Throughout the course, site and personal safety procedures along with business principles will be emphasized.

Power Sports

Subject Code: 010240

Students will examine operating systems and perform maintenance practices for power sport off road and water vehicles. Students will learn engine theory, components, lubrication and cooling in order to diagnose service and repair. Topics also include the maintenance of electrical, fuel, air induction and exhaust systems of power engines. Power sport suspension, transmission, and braking systems are studied while students maintain site and personal safety and develop business principles throughout the course.

Power Trains

Subject Code: 010230

Students will learn the physical principles of power trains, the components that transfer and control power, and how power trains are designed to function. Topics include hydraulic theory, bearings and seals along with belts, chains, and gear drives included in power trains. Students will learn how to adjust and maintain transmissions along with diagnosing power take-off devices and clutches. Throughout the course, site and personal safety procedures along with business principles are emphasized.

Animal Science and Technology

Subject Code: 010910

Students will learn and apply responsible animal management principles and routine husbandry practices. Topics will include nutrition, feeding, and caring for animals, body/carcass composition evaluation, and applying marketing principles to the sale and distribution of animal products. Learners will investigate animal genetics and how it impacts principles of animal improvement, selection and marketing. Throughout the course, learners will develop business leadership, problem-solving and communication skills in relation to the science of animals.

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Animal Anatomy and Physiology

Subject Code: 010945

Students will examine the structure and function of the major organ systems as well as the function and principle of blood flow in animals. Students will study internal and external anatomical parts, their functions, and will investigate the relationship among these parts and systems within the body of animal. Throughout the course, students will apply the internal functions of anatomical structures to the business and industry principles of the animal industry.

Animal Health

Subject Code: 010915

Students will examine causes, symptoms, and treatment of common diseases with emphasis on developing preventative health management plans. Topics will include the study of pathogens, and classifying types of diseases and disorders. Students will perform animal health assessments and compare to standard characteristics. Throughout the course, students will utilize principles of technology to manage information systems, and research issues affecting the industry.

Medical Terminology

Subject Code: 072150

This course focuses on the applications of the rules for constructing and defining medical terms with an emphasis on building a working medical vocabulary. Topics include using the appropriate abbreviations and symbols for anatomical, physiological and pathological classifications and the associated medical specialties and procedures. Students will decipher medical terms by identifying and using word elements with an emphasis on derivation, meaning, and pronunciation. Further, students will interpret and translate medical records and documents.

Companion Animal Selection, Nutrition and Management

Subject Code: 010925

Students will identify and apply responsible animal science principles and routine husbandry practices to companion animals. Topics will include principles and practices of nutrient utilization, breeding programs and management of facility/housing design, meal plans and general care practices. Students will apply knowledge of companion animal care to enhance animal growth, enrichment, training, and education engagement programs. Throughout the course, students will follow practices for care and legal compliance in relation to classification of animals.

Livestock Selection, Nutrition and Management

Subject Code: 010920

Students will identify and apply principles and routine husbandry practices to production animal populations. Topics will include principles of nutrition, feed utilization, animal welfare, selection and management of facilities and herd populations. Students will apply knowledge of production animal care to enhance animal growth, selection of breeding stock, and management practices. Throughout the course, students will develop management plans reflecting practices for care and legal compliance.

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Equine Selection, Nutrition and Management

Subject Code: 010935

Students will identify and apply responsible animal science principles and management practices to equine populations. Topics will include equine nutrition, selection, reproduction and facility design and management. They will apply knowledge of equine science to enhance animal growth, enrichment and training, along with providing educational and visitor engagement programs. Throughout the course, students will develop management plans that reflect the classification of animals and follows best practices for care and legal compliance.

Zoo and Aquarium

Subject Code: 010940

Students will apply responsible animal science principles and routine husbandry practices to captive animal populations. Learners will apply knowledge of animal behavior, welfare, and husbandry principles to enhance exhibit design, animal enrichment and training plans, and educational engagement programs. Emphasis will be given to data collection and research techniques. Students will apply principles of responsible population control, disease risk and management, and problem-solving/action planning techniques.

Veterinary Science

Subject Code: 010930

Students will learn causes, symptoms, and treatment of common diseases with special emphasis on developing preventative health management plans and breeding programs. Topics include veterinary pharmacology, radiology and imaging techniques, principles of surgery, safe laboratory skills, and the concepts of ethics and professionalism in the work place. Students will develop skills in inquiry and statistical methods. Throughout the course, learners will utilize principles of technology to manage information systems, and research issues affecting the industry.

Science & Technology of Food

Subject Code: 011010

Students will examine the research, marketing, processing and packaging techniques applied to the development of food products. Learners will examine nutrient content and their chemical makeup, while applying principles of chemistry to the development of food products. They will examine and implement food safety, sanitation, and quality assurance protocols. Government regulations and food legislation will be examined and the implications to food science and technology will be identified.

Animal and Plant Biotechnology

Subject Code: 012010

Learners will apply principles of chemistry, microbiology and genetics to plant and animal research and product development. Students will apply genetic principles to determine genotypes and phenotypes. Students will describe the parts and functions of animal and plant cells and their importance in biochemistry. They will perform restrictive enzyme digests, Polymerase Chain Reactions and apply principles of nucleic acid blotting. This course will examine applications of Central Dogma Theory and other Molecular-Genetics Technologies.

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Food Marketing and Research

Subject Code: 011015

Learners will focus on the stages of the research process from research planning to gathering, analysis, and interpretation of data as it relates to food marketing management. Learners will apply knowledge of food additives, nutrition, mixes and solutions to enhance existing food products and to create new processed foods. Learners will identify and describe the impact that technological advances have on food production and availability. Cultural trends and preferences affecting product development will be examined.

Meat Science and Technology

Subject Code: 011020

Students will apply food chemistry and microbiology to processing, preservation, packaging, storage and marketing of meat products. Students will design and implement a quality assurance program that meets legal compliance and demonstrates knowledge of safe operation and maintenance of equipment and facilities. Students will evaluate carcass composition, assign quality grades, and examine valued-added products. Throughout the course, students will demonstrate customer service and sales techniques while understanding the scope and importance of business and safety regulations.

Genetics of Plants and Animals

Subject Code: 012020

Students gain knowledge and skill in genetic principles and mechanisms of heredity. Students perform applications using knowledge of DNA and chromosome structure, transcription and gene regulation; replication and cell division; patterns of inheritance; and genetic recombination mutations and their repair. Learners will apply molecular principles to food, plant and animal research and present findings through various forms of communication.

Principles and Practices of Bioscience

Subject Code: 012015

Students will use concepts, procedures, and equipment common to a professional laboratory for agricultural product development and research. Students conduct problem-based studies, and apply scientific methodology. Students will follow procedures and protocols for handling, transporting, storing, and preparing plant and animal specimens. Further, students will perform techniques including chemical separations, centrifugation, distillation and filtration. Emphasis is given to demonstrating safe, professional and ethical behavior associated with the field.

Applications of Food Science and Safety

Subject Code: 011030

Learners demonstrate principles and practices of food safety, processing and packaging to develop solutions for problems in food production, handling and storage. Learners will examine a full range of food processing techniques. Learners will examine the process of food product development and techniques used to measure food sensory aspects, shelf life and food stability. Learners will examine government regulation impact on labeling, new packaging technologies, harvesting, transportation, and the environment. Food laws, regulations and regulatory and commercial grading standards will be examined.

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Bioresearch

Subject Code: 012025

Learners in this course will apply knowledge of bioinformatics, plant and animal microbiology, and chemistry to data mining and laboratory techniques. Students will perform procedures of developing bio-products to solve issues facing agriculture. In this course, students will also be introduced to bioinformatics related to genome analysis for research and present their overall findings.

Plant and Horticultural Science

Subject Code: 010155

This first course in the pathway focuses on the knowledge and skills required to research, develop, produce and market agricultural, horticultural, and native plants and plant products. Students will apply principles of plant physiology and anatomy, plant protection and health, reproductive biology in plants, plant nutrition and disorders to the management of soils and plants. Throughout the course, students will learn communication, leadership, and business management skills reflective of the industry.

Floral Design and Marketing

Subject Code: 010625

Students will use principles and elements of design to create various types and styles of floral arrangements with natural and artificial plants and plant products. Topics will include identification of ornamental plants and cut flowers, use of design materials, and storage and handling applications. Students will develop successful business, communication, marketing, and sales strategies for use in the floral industry.

Greenhouse and Nursery Management

Subject Code: 010610

Students will learn the operational practices needed for the successful growth of nursery stock and/or greenhouse plants. They will learn essential greenhouse practices including water and fertilizer distribution, lighting, ventilation and temperature control. Students will learn pest and disease identification and control along with bio-security practices. Students will demonstrate knowledge of propagation methods, plant health, nutrition, and growth stimulation. Throughout this course, business and employability skills will be emphasized.

Landscape Design

Subject Code: 010630

Students will learn skills in creating blueprints, estimates and landscaping designs. Topics include basic principles of design, engineering, drawing and drafting techniques including the use of technology such as computer-aided design. Students will incorporate principles of hardscapes and examine the use of artificial lighting, water systems, and creative features in their designs. Throughout the course, business management practices, employability skills, and safety procedures will also be emphasized.

Landscape Hardscapes

Subject Code: 010640

Students will learn skills in constructing and installing hardscape features in a landscape. Topics include basic principles of building and implementing designs drawn and drafted from computer-aided designs and blueprints. Students will install artificial lighting, water systems, deck and creative concrete features on job sites. Throughout the course, business management practices, employability skills, and safety procedures will also be emphasized.

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Landscape Systems Management

Subject Code: 010615

Students will learn methods for establishing and managing landscapes to promote growth and balance. The classification and care of woody and herbaceous landscape plants will be learned. Students will learn to optimize growing conditions, balance nutrients, and manage pests and disease. They will apply proper planting, fertilizing, and pruning techniques while safely operating well maintained specialized equipment. Throughout the course, students will assess implications of landscape installation on the environment, and employ communication, business, and management strategies.

Turf Science and Management

Subject Code: 010635

Students will apply principles of science, engineering, and business to support the establishment and maintenance of residential, athletic and recreational turf. Students will learn techniques for the establishment, care, production, and marketing of turf grass along with safe operation and maintenance of specialized equipment. Throughout the course, environmental awareness and conservation practices will be emphasized along with communication, business, and management strategies appropriate for the industry.

Natural Resources

Subject Code: 010710

Students will apply science principles and management practices to the protection of renewable and non-renewable natural resources. Students will learn fundamentals of land use as well as watershed, wildlife, fishery and forest management. Furthermore, students will learn management practices related to managing air and water quality along with requirements for managing solid and liquid waste. Throughout the course, students will apply communications, business principles and leadership skills.

Energy Systems Management

Subject Code: 010715

Students will apply basic principles of energy accounting, thermodynamics and heat transfer, energy conversion and efficiency to heating, power generation and transportation. Students will apply the principles and practices needed for managing renewable and non-renewable energy resources. Throughout this course, future energy systems and energy use scenarios are investigated, with a focus on promoting the use of renewable energy resources and technologies.

Environmental Science for Agriculture and Natural Resources

Subject Code: 010720

Students will study relationships between organisms and their environment. Principles of biogeochemical cycles, air-water-land relationships, non-point pollution, and wetlands will be applied. Students will examine fundamentals of resource development, agriculture sustainability, energy needs and pollution control. They will analyze and interpret data gathered from studies on the ecosystem. Throughout this course, students will develop responses to environmental problems and develop management strategies for responsible conservation and resource development.

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Environmental Systems Management

Subject Code: 010725

Students will analyze and interpret biological, chemical and physical properties of soil, water and air. They will determine the source and type of environmental contamination evaluate pollution control measures and monitor treatment processes for potable water, waste water and solid waste. Throughout the course, learners will develop and implement environmental plans using principles governing ecosystems in relation to resource development and industrial processes.

Forestry and Woodland Ecosystems

Subject Code: 010730

Students will apply principles of botany, dendrology and silviculture to the management of forests and forest ecosystems. They will apply principles of timber cruising with surveying and mapping techniques to take forest measurements. Learners will develop the knowledge and skills necessary for forest reforestation, timber stand improvement, timber harvesting and forest product utilization. Learners will operate and maintain forestry equipment, apply fire management practices, and understand related regulations, laws, and policy issues.

Park and Recreational Management

Subject Code: 010735

Students will design facilities, develop educational programs and manage resources for use in public recreation. Students will maintain and operate equipment for maintaining wildlife habitat and supporting a variety of public recreational activities and facilities. Throughout the course, students will develop marketing and programming skills for park development, apply management practices to park operations and learn the systems required to maintain public safety.

Urban Forestry

Subject Code: 010740

Students will apply techniques and practices promoting the care and management of trees for residential and commercial purposes. Topics include principles of soil management, dendrology and pest management. Students will analyze budgets; and develop short and long-range management plans that balance environmental and economic goals supporting sustainable land use patterns. Throughout the course, students will apply principles of rigging, advanced rope techniques, and chainsaw applications for tree pruning and removal.

Wildlife and Fisheries

Subject Code: 010745

Learners will apply the principles and practices of resource conservation and management to fish and wildlife populations. Students will learn proper wild animal handling techniques, principles of wildlife nutrition, inventory practices, water quality parameters and testing, and natural and artificial propagation. Learners will apply principles of facility design and layout for managing fish populations. Throughout the course, learners will research and evaluate the impacts of various land practices, legislation, and human activities on habitats and populations.

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Oil and Gas Operations

Subject Code: 010718

Students will develop the skills applicable for the exploration, extraction and production of-petroleum, natural gas and coal. They will learn practices related to the exploration, leasing, surveying, drilling, geophysical logging and completion process. Students will become familiar with wellhead and surface production equipment. Throughout the course, students will learn sampling, analysis, monitoring and control techniques for effective environmental management in the extractive industries.

Bio Energy

Subject Code: 010716

Students will be introduced to the scientific and technical processes of biofuel/bioenergy production. Learners will evaluate the energy conversion process and methods for optimizing the fermentation process. Students will identify the systems and components employed by fermentation systems and communicate safe handling techniques of biomass, effluent and biogas. Throughout the course, students will evaluate environmental impacts, life-cycle analysis, and economic analysis of bioenergy production.

Solar and Wind Energy

Subject Code: 010717

Students will conduct Energy Site Assessments by using and interpreting resource maps, performance data, zoning requirements and interferences, installation timelines and price. They will read plans, lay out components and assemble electrical system components. Students will perform system checkouts and interpret results from mechanical and electrical diagnostic reports and compile and maintain system records. Throughout the course, students will apply safety regulations and identify and resolve public safety issues.