

# FY2027 Energy & Natural Resources Career Field Pathways and Course Structure

| <b>Natural Resource Management<br/>A6<br/>Pathway Courses</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Energy Generation &amp; Extraction Technologies<br/>K1<br/>Pathway Courses</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Energy Transmission and Distribution Systems<br/>K2<br/>Pathway Courses</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Energy Design and Operations Management<br/>K3<br/>Pathway Courses</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>• <b>010105</b> Agriculture, Food and Natural Resources<sup>1</sup></li> <li>• <b>010710</b> Natural Resources<sup>2</sup></li> <li>• <b>012030</b> Foundation of Sustainable and Innovative Agriculture<sup>1</sup></li> <li>• <b>012035</b> Precision Applications in Agriculture, Food and Natural Resources</li> <li>• <b>010115</b> Business Management for Agricultural and Environmental Systems</li> <li>• <b>400010</b> Energy Capstone</li> <li>• <b>010720</b> Environmental Science for Agricultural and Environmental Systems</li> <li>• <b>010725</b> Environmental Systems Management</li> <li>• <b>010730</b> Forestry and Woodland Ecosystems</li> <li>• <b>010735</b> Park and Recreational Management</li> <li>• <b>010740</b> Urban Forestry</li> <li>• <b>010745</b> Wildlife and Fisheries</li> </ul> | <ul style="list-style-type: none"> <li>• <b>010715</b> Energy Systems Management<sup>1</sup></li> <li>• <b>010716</b> Bio Energy<sup>2</sup></li> <li>• <b>010717</b> Solar and Wind Energy<sup>2</sup></li> <li>• <b>010718</b> Oil and Gas Operations<sup>2</sup></li> <li>• <b>178018</b> Construction Safety and Crew Leadership</li> <li>• <b>010225</b> Hydraulics and Pneumatics</li> <li>• <b>010720</b> Environmental Science for Agriculture and Natural Resources</li> <li>• <b>176020</b> Industrial Maintenance</li> <li>• <b>178010</b> Pipefitting and Plumbing Systems</li> <li>• <b>178016</b> Alternative Power Generation System</li> <li>• <b>178026</b> Heavy Equipment Operations</li> <li>• <b>178027</b> Construction Surveying and Site Logistics</li> <li>• <b>400010</b> Energy Capstone</li> <li>• <b>176009</b> Welding Technologies</li> <li>• <b>177024</b> Unmanned Aircraft Systems</li> <li>• <b>178022</b> Construction Management</li> </ul> | <ul style="list-style-type: none"> <li>• <b>010715</b> Energy Systems Management<sup>1</sup></li> <li>• <b>178017</b> Powerline/Hi-Voltage Power Transmission<sup>2</sup></li> <li>• <b>178018</b> Construction Safety and Crew Leadership</li> <li>• <b>010225</b> Hydraulics and Pneumatics</li> <li>• <b>176009</b> Welding Technologies</li> <li>• <b>178007</b> Construction Electrical Systems</li> <li>• <b>178009</b> Commercial and Industrial Construction Electrical Systems</li> <li>• <b>178010</b> Pipefitting and Plumbing Systems</li> <li>• <b>178022</b> Construction Management</li> <li>• <b>178026</b> Heavy Equipment Operations</li> <li>• <b>178027</b> Construction Surveying and Site Logistics</li> <li>• <b>176060</b> Battery Technologies</li> <li>• <b>400010</b> Energy Capstone</li> <li>• <b>010720</b> Environmental Science for Agricultural and Natural Resources</li> <li>• <b>177024</b> Unmanned Aircraft Systems</li> </ul> | <ul style="list-style-type: none"> <li>• <b>175015</b> Pre-Engineering Technologies<sup>1</sup></li> <li>• <b>010715</b> Energy Systems Management<sup>2</sup></li> <li>• <b>175002</b> Engineering Principles</li> <li>• <b>175017</b> Engineering Logic</li> <li>• <b>010720</b> Environmental Science for Agriculture and Natural Resources</li> <li>• <b>142020</b> Operations Management</li> <li>• <b>142030</b> Logistics Management</li> <li>• <b>175008</b> Mechanical Engineering</li> <li>• <b>175100</b> AC Electronic Circuits</li> <li>• <b>175105</b> DC Electronic Circuits</li> <li>• <b>178009</b> Commercial and Industrial Construction Electrical Systems</li> <li>• <b>176060</b> Battery Technologies</li> <li>• <b>400010</b> Energy Capstone</li> <li>• <b>010225</b> Hydraulics and Pneumatics</li> <li>• <b>010716</b> Bio Energy</li> <li>• <b>010717</b> Solar and Wind Energy</li> <li>• <b>010718</b> Oil and Gas Operations</li> <li>• <b>178016</b> Alternative Power Generation Systems</li> </ul> |

(<sup>1</sup>) Recommended First Course; (<sup>2</sup>) Recommended Second Course

## COURSES IN NATURAL RESOURCE MANAGEMENT (A6)

| Pathway Course Name                                               | Subject Code |
|-------------------------------------------------------------------|--------------|
| Agriculture, Food and Natural Resources                           | 010105       |
| Business Management for Agricultural and Environmental Systems    | 010115       |
| Energy Capstone                                                   | 400010       |
| Environmental Science for Agricultural and Environmental Systems  | 010720       |
| Environmental Systems Management                                  | 010725       |
| Forestry and Woodland Ecosystems                                  | 010730       |
| Foundation of Sustainable and Innovative Agriculture <sup>1</sup> | 012030       |
| Natural Resources <sup>2</sup>                                    | 010710       |
| Park and Recreational Management                                  | 010735       |
| Precision Applications in Agriculture, Food and Natural Resources | 012035       |
| Urban Forestry                                                    | 010740       |
| Wildlife and Fisheries                                            | 010745       |

### **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.

### **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 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.

### **Energy Capstone**

Subject Code: 400010

Students apply Energy pathway 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, and internships.

## **Environmental Science for Agriculture and Natural Resources**

Subject Code: 010720

Students will study relationships between organisms in an ecosystem and the impact of those relationships on the environment. Students will investigate how different ecosystems function and respond to changes in various biological, chemical, and geological processes. Students will examine fundamentals of resource development, agriculture sustainability, energy needs and pollution control. Students will develop a basic understanding of the scientific method and learn to analyze and interpret data gathered from studies on the ecosystem. Throughout this course, students will develop responses to current and historic environmental problems and develop management strategies for responsible conservation and development of resources to meet world demand.

## **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, wastewater 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**

Source Code: 010730

Learners will apply principles of botany, dendrology and silviculture to the management of forests and forest ecosystems. Learners 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.

## **Foundations of Sustainable and Innovative Agriculture and Natural Resources**

Subject Code: 012030

This course will focus on the purpose, resources, indoor and outdoor growing operations, production strategies, business development, and financing as it applies to innovative agricultural production in urban, suburban, and rural communities: This course will focus on the purpose, resources, indoor and outdoor growing operations, production strategies, business development, and financing as it applies to innovative agricultural production in urban, suburban, and rural communities.

## **Natural Resources**

Subject Code: 010710

Students will learn the principles of plant science and apply management practices for the protection and conservation of natural resources. Students will observe plant associations in nature and discover the basic principles of phytogeography, ecology, and conservation. Students will learn the fundamentals of soils, land use, water, waste, and wildlife management to identify human impacts on natural resources. Furthermore, students will learn to identify, track, and monitor wildlife, forest, water, air, soil, and energy development to protect and conserve renewable and non-renewable resources. Throughout the course,

students will apply communications, business principles and leadership skills to demonstrate career readiness in a natural resource's related career.

### **Park and Recreational Management**

Subject Code: 010735

Students will be introduced to the historic, philosophical, and scientific foundation of leisure, the nature and scope of the park and recreation profession, and common leisure service industry practices. By developing educational programs and manage resources for use in public recreation. Maintaining and operate equipment to support park and recreational activities and facilities. Students will develop marketing skills and apply management practices to park and recreation operations throughout the course.

### **Precision Applications in Agriculture, Food and Natural Resources**

Subject Code: 012035

This course will provide a comprehensive overview of precision agriculture, emphasizing the integration of technology, data analysis, and sustainable practices to optimize production and resource utilization. Students will gain knowledge in the areas of electrical theory, electronic systems and controls applied to mapping, GIS, and equipment operation. Students will maintain, troubleshoot, and repair precision systems and components used in harvesting and storing agricultural and natural resources products.

### **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. Furthermore, 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 conservation and ecology to maintain, manage, and promote fish and wildlife populations. Students will learn proper animal identification, nutrition, morphology, physiology, and handling techniques of species common to the region. Throughout the course, learners will research and evaluate the interrelationship between animals and human activities on habitats and populations of fish and wildlife.

## COURSES IN ENERGY GENERATION & EXTRACTION TECHNOLOGIES (K1)

| Pathway Course Name                                         | Subject Code |
|-------------------------------------------------------------|--------------|
| Bio Energy <sup>2</sup>                                     | 010716       |
| Alternative Power Generation Systems                        | 178016       |
| Construction Management                                     | 178022       |
| Construction Safety and Crew Leadership                     | 178018       |
| Construction Surveying and Site Logistics                   | 178027       |
| Energy Capstone                                             | 400010       |
| Energy Systems Management <sup>1</sup>                      | 010715       |
| Environmental Science for Agriculture and Natural Resources | 010720       |
| Heavy Equipment Operations                                  | 178026       |
| Hydraulics and Pneumatics                                   | 010225       |
| Industrial Maintenance                                      | 176020       |
| Oil and Gas Operations <sup>2</sup>                         | 010718       |
| Pipefitting and Plumbing Systems                            | 178010       |
| Solar and Wind Energy <sup>2</sup>                          | 010717       |
| Unmanned Aircraft Systems                                   | 177024       |
| Welding Technologies                                        | 176009       |

### Bio Energy

Subject Code: 010716

Students are 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 equipment, biomass, effluent and biogas. A focus will be given to environmental impacts, life-cycle analysis, and economic analysis of bio-energy production.

### Alternative Power Generation Systems

Subject Code: 178016

Students will learn the technology and applications of solar and wind energy with an emphasis on installation and service processes. Content includes identifying the functions of photovoltaic, standby power and electric storage systems. Students will perform battery maintenance and implement principles and guidelines of energy analysis needed to carry out effective energy audits in accordance with standards and codes.

### Construction Management

Subject Code: 178022

This course provides an integrated look at balancing the planning, estimating, and directing of construction operations. Students learn the process of creating and monitoring a construction project including standard agreements, bidding, estimates and project schedules. Students will learn to manage change orders, accident prevention and loss control, closeouts, and claims with an emphasis in

production and quality control. Additionally, students will apply leadership, communications, and problem-solving skills to construction management.

### **Construction Safety and Crew Leadership**

Subject Code: 178018

This course covers OSHA standards (30-hr OSHA) and requirements as they apply to the construction industry and crew/project management. Topics include safety and health hazards, safe practices, construction safety management, and crew management. Emphasis is on hazard identification, avoidance, control and preven.

### **Construction Surveying and Site Logistics**

Subject Code: 178027

Students use surveying, topographic, satellite positioning, and geometric instruments to locate and prepare a site for construction. Students establish lot and building lines as well as grade levels, and use site plans and elevation drawings to determine excavation needs. Students locate and mark underground and overhead services, identify soil conditions that may require shoring and position batter boards. Additionally, students identify the parameters for site selection, zoning regulations, and the process for filing building permits.

### **Energy Capstone**

Subject Code: 400010

Students apply Energy pathway 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, and internships.

### **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 both renewable and non-renewable energy sources including, solar thermal, hydrogen generation, photovoltaic, hydroelectric, biomass use, geothermal heat transfer, and fossil fuel. 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 in an ecosystem and the impact of those relationships on the environment. Students will investigate how different ecosystems function and respond to changes in various biological, chemical, and geological processes. Students will examine fundamentals of resource development, agriculture sustainability, energy needs and pollution control. Students will develop a basic understanding of the scientific method and learn to analyze and interpret data gathered from studies on the ecosystem. Throughout this course, students will develop responses to

current and historic environmental problems and develop management strategies for responsible conservation and development of resources to meet world demand.

### **Heavy Equipment Operations**

Subject Code: 178026

Students perform heavy equipment operating techniques and perform operator level maintenance. Students will learn to survey using lasers, transits and machine control systems. Additionally, students learn the techniques and processes for clearing, grubbing, stripping, excavating, backfilling, stockpiling, and cutting and spreading of fill material. Throughout the course, safety is emphasized.

### **Hydraulics and Pneumatics**

Subject Code: 010225

In the Hydraulics and Pneumatics course, students will learn physical principles of hydraulics. They will diagnose problems, test system components, learn how to properly maintain hydraulic circuits and diagnose and test problem areas in hydraulics systems of agricultural and industrial power equipment.

### **Industrial Maintenance**

Subject Code: 176020

Students will apply the knowledge and skills for installing, maintaining and safely troubleshooting industrial machinery. Students will learn principles of pneumatic, hydraulic, mechanical, and electrical systems. They will solve practical maintenance problems, read and interpret drawings/maintenance manuals and learn manufacturing process quality practices. Lastly, students will troubleshoot electrical controls, sensors and actuators for automated machinery and manufacturing processes.

### **Oil and Gas Operations**

Subject Code: 010718

Students will develop the skills applicable to careers in petroleum, natural gas and coal industries. They will learn practices related to exploration, leasing, surveying, drilling, geophysical logging and completion process. Students will be familiar with wellhead and surface production equipment and interpret production histories and graphs. Students will learn sampling, analysis, monitoring and control techniques for effective environmental management in the extractive industries and the principals of metering, sales and marketing.

### **Pipefitting and Plumbing Systems**

Subject Code: 178010

This course will emphasize the physical principles, general methods, materials and equipment used in the plumbing and pipefitting. Students will learn worksite safety and understand licensing and permitting requirements. They will interpret plans and job specifications and calculate service requirements. Students will rough in water supply and drainage lines following plumbing codes and municipal building standards. Additionally, students will install and maintain plumbing fixtures.



## **Solar and Wind Energy**

Subject Code: 010717

Students will specify system options by conducting Energy Site Assessments by using and interpreting resource maps, performance data, zoning requirements and interferences, installation timelines and price. Students will read plans, lay out components and assemble electrical systems. Students will perform system checkouts and interpret results from mechanical and electrical diagnostic reports and compile and maintain system records. Students will apply safety regulations and requirements and identify and mitigate public safety issues during system installations.

## **Unmanned Aircraft Systems**

Subject Code: 177024

Students will learn the essentials of operating an unmanned aircraft in a variety of environments. Students will learn principles of regulations, operations, air space, and navigation. Additionally, students will acquire and use geospatial information for various applications.

## **Welding Technologies**

Subject Code: 176009

Students will use fundamental welding principles involving shielded metal arc, oxyacetylene, gas tungsten, and gas metal arc welding in the flat, horizontal, and vertical positions. An emphasis is given to electrode selection, equipment setup, operating procedures, welding inspection, and testing. Students will learn joint designs and layout and will be introduced to welding codes and standards. Additional topics include employability skills and an emphasis will be given to personal safety.



## COURSES IN ENERGY TRANSMISSION AND DISTRIBUTION SYSTEMS (K2)

| Pathway Course Name                                         | Subject Code |
|-------------------------------------------------------------|--------------|
| Battery Technologies                                        | 176060       |
| Commercial and Industrial Construction Electrical Systems   | 178009       |
| Construction Electrical Systems                             | 178007       |
| Construction Management                                     | 178022       |
| Construction Safety and Crew Leadership                     | 178018       |
| Construction Surveying and Site Logistics                   | 178027       |
| Energy Capstone                                             | 400010       |
| Energy Systems Management <sup>1</sup>                      | 010715       |
| Environmental Science for Agriculture and Natural Resources | 010720       |
| Heavy Equipment Operations                                  | 178026       |
| Hydraulics and Pneumatics                                   | 010225       |
| Pipefitting and Plumbing Systems                            | 178010       |
| Powerline/Hi-Voltage Power Transmission <sup>2</sup>        | 178017       |
| Unmanned Aircraft Systems                                   | 177024       |
| Welding Technologies                                        | 176009       |

### Battery Technologies

Subject Code: 176060

Students examine battery technology with a focus on design, function, and manufacturing. They explore battery chemistries, energy storage principles, and performance factors such as capacity, efficiency, and lifespan. Students study battery production processes, materials, and environmental impacts, while learning to test, select, and safely handle batteries for various applications. Emphasis is placed on emerging technologies, industry standards, and the critical role of batteries in modern electrical and electronic systems.

### Commercial and Industrial Construction Electrical Systems

Subject Code: 178009

Students will plan and install electrical systems in commercial settings. Students learn worksite safety and understand permitting requirements. Students interpret plans and job specifications and calculate loads and service requirements. Students install, test and repair receptacle outlet, lighting and equipment circuits. They will understand circuit protection concepts and be able to install entrance panels. Specialty commercial circuit installation will be addressed. Students apply operating principles to the installation and troubleshooting of motors and controls.

## **Construction Electrical Systems**

Subject Code: 178007

This introductory electrical course will emphasize electrical theory, materials, equipment. Students will explore the National Electrical Code and learn worksite safety. They will interpret schematics; construct basic circuits, use test equipment and electrical hand and power tools.

## **Construction Management**

Subject Code: 178022

This course provides an integrated look at balancing the planning, estimating, and directing of construction operations. Students learn the process of creating and monitoring a construction project including standard agreements, bidding, estimates and project schedules. Students will learn to manage change orders, accident prevention and loss control, closeouts, and claims with an emphasis in production and quality control. Additionally, students will apply leadership, communications, and problem-solving skills to construction management.

## **Construction Safety and Crew Leadership**

Subject Code: 178018

This course covers OSHA standards (30-hr OSHA) and requirements as they apply to the construction industry and crew/project management. Topics include safety and health hazards, safe practices, construction safety management, and crew management. Emphasis is on hazard identification, avoidance, control and prevention.

## **Construction Surveying and Site Logistics**

Subject Code: 178027

Students use surveying, topographic, satellite positioning, and geometric instruments to locate and prepare a site for construction. Students establish lot and building lines as well as grade levels, and use site plans and elevation drawings to determine excavation needs. Students locate and mark underground and overhead services, identify soil conditions that may require shoring and position batter boards. Additionally, students identify the parameters for site selection, zoning regulations, and the process for filing building permits.

## **Energy Capstone**

Subject Code: 400010

Students apply Energy pathway 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, and internships.

## **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 both renewable and non-renewable energy sources including, solar thermal, hydrogen generation, photovoltaic, hydroelectric, biomass use, geothermal heat transfer, and fossil fuel. 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 in an ecosystem and the impact of those relationships on the environment. Students will investigate how different ecosystems function and respond to changes in various biological, chemical, and geological processes. Students will examine fundamentals of resource development, agriculture sustainability, energy needs and pollution control. Students will develop a basic understanding of the scientific method and learn to analyze and interpret data gathered from studies on the ecosystem. Throughout this course, students will develop responses to current and historic environmental problems and develop management strategies for responsible conservation and development of resources to meet world demand.

## **Heavy Equipment Operations**

Subject Code: 178026

Students perform heavy equipment operating techniques and perform operator level maintenance. Students will learn to survey using lasers, transits and machine control systems. Additionally, students learn the techniques and processes for clearing, grubbing, stripping, excavating, backfilling, stockpiling, and cutting and spreading of fill material. Throughout the course, safety is emphasized.

## **Hydraulics and Pneumatics**

Subject Code: 010225

In the Hydraulics and Pneumatics course, students will learn physical principles of hydraulics. They will diagnose problems, test system components, learn how to properly maintain hydraulic circuits and diagnose and test problem areas in hydraulics systems of agricultural and industrial power equipment.

## COURSES IN ENERGY DESIGN AND OPERATIONS MANAGEMENT (K3)

| Pathway Course Name                                         | Subject Code |
|-------------------------------------------------------------|--------------|
| AC Electronic Circuits                                      | 175100       |
| Battery Technologies                                        | 176060       |
| Bio Energy                                                  | 010716       |
| Alternative Power Generation Systems                        | 178016       |
| DC Electronic Circuits                                      | 175105       |
| Energy Capstone                                             | 400010       |
| Energy Systems Management <sup>2</sup>                      | 010715       |
| Engineering Logic                                           | 175017       |
| Engineering Principles                                      | 175002       |
| Environmental Science for Agriculture and Natural Resources | 010720       |
| Hydraulics and Pneumatics                                   | 010225       |
| Logistics Management                                        | 142030       |
| Mechanical Engineering                                      | 175008       |
| Oil and Gas Operations                                      | 010718       |
| Operations Management                                       | 142020       |
| Pre-Engineering Technologies <sup>1</sup>                   | 175015       |
| Solar and Wind Energy                                       | 010717       |

### AC Electronic Circuits

Subject Code: 175100

Students will learn the fundamental principles of electricity with emphasis on AC (alternating current) circuits. They will use concepts of Ohm's Law, the Power Formula, and Kirchhoff's Laws with series, parallel, and series-parallel circuit applications. Additionally, students will be introduced to the relationship between electricity, magnetism, and motor theory. Lastly, students will learn principles of electrical safety, breadboard wiring, basic circuit troubleshooting, operation of function generator, digital multimeter (DMM) and oscilloscope.

### Battery Technologies

Subject Code: 176060

Students examine battery technology with a focus on design, function, and manufacturing. They explore battery chemistries, energy storage principles, and performance factors such as capacity, efficiency, and lifespan. Students study battery production processes, materials, and environmental impacts, while learning to test, select, and safely handle batteries for various applications. Emphasis is placed on emerging technologies, industry standards, and the critical role of batteries in modern electrical and electronic systems.

## **Bio Energy**

Subject Code: 010716

Students are 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 equipment, biomass, effluent and biogas. A focus will be given to environmental impacts, life-cycle analysis, and economic analysis of bio-energy production.

## **Alternative Power Generation Systems**

Subject Code: 178016

Students will learn the technology and applications of solar and wind energy with an emphasis on installation and service processes. Content includes identifying the functions of photovoltaic, standby power and electric storage systems. Students will perform battery maintenance and implement principles and guidelines of energy analysis needed to carry out effective energy audits in accordance with standards and codes.

## **DC Electronic Circuits**

Subject Code: 175105

Students will learn the fundamental principles of electricity with emphasis on DC (direct current) circuits. They will learn terminology associated with DC circuits and apply the concepts of Ohm's and Kickoff's Laws as they apply to series, parallel, and series-parallel circuits. Students will also learn electrical safety, basic circuit troubleshooting, operation of DC power supply and digital multimeter (DMM) use. Lastly, students will also learn to draw circuit schematics and breadboard circuits.

## **Energy Capstone**

Subject Code: 400010

Students apply Energy pathway 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, and internships.

## **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 both renewable and non-renewable energy sources including, solar thermal, hydrogen generation, photovoltaic, hydroelectric, biomass use, geothermal heat transfer, and fossil fuel. Future energy systems and energy use scenarios are investigated, with a focus on promoting the use of renewable energy resources and technologies.

## **Engineering Logic**

Subject Code: 175017

Students will apply the processes of digital circuit theory, combinational and sequential logic as it relates to circuit design and operation. Students will identify numbering systems, arithmetic and Boolean operations and apply simplification methods. Emphasis will be given to the analysis of wiring schematics and diagrams for accuracy and function. In addition, students will use electronic components to construct and troubleshoot digital circuits.

## **Engineering Principles**

Subject Code: 175002

This course will introduce students to fundamental engineering concepts and scientific principles associated with engineering design applications. Topics include mechanisms, energy, statics, materials, and kinematics. Additionally, students will learn material properties and electrical, control and fluid power systems. Students will learn to apply problem-solving, research and design skills to create solutions to engineering challenges.

## **Environmental Science for Agriculture and Natural Resources**

Subject Code: 010720

Students will study relationships between organisms in an ecosystem and the impact of those relationships on the environment. Students will investigate how different ecosystems function and respond to changes in various biological, chemical, and geological processes. Students will examine fundamentals of resource development, agriculture sustainability, energy needs and pollution control. Students will develop a basic understanding of the scientific method and learn to analyze and interpret data gathered from studies on the ecosystem. Throughout this course, students will develop responses to current and historic environmental problems and develop management strategies for responsible conservation and development of resources to meet world demand.

## **Hydraulics and Pneumatics**

Subject Code: 010225

In the Hydraulics and Pneumatics course, students will learn physical principles of hydraulics. They will diagnose problems, test system components, learn how to properly maintain hydraulic circuits and diagnose and test problem areas in hydraulics systems of agricultural and industrial power equipment.

## **Logistics Management**

Subject Code: 142030

Students will develop plans and networks to move materials, information, products, and services through organizations. Students will analyze transportation cost structures and reverse logistics' costs. They will utilize technology to evaluate warehouse size and space layouts. Students will also design receiving and fulfillment processes and develop preventive maintenance schedules. Requirements for the treatment, storage, and disposal of hazardous materials will be emphasized. Project management techniques and international business will be examined.

## **Mechanical Engineering**

Subject Code: 175008

Learners develop the ability to interpret mechanical schematics and blueprints to accurately assemble and maintain mechanical systems. They apply technical math and scientific principles to analyze system performance and solve practical problems. Emphasis is placed on effective troubleshooting techniques, preventive maintenance, and adherence to safety standards to ensure reliable operation and workplace safety.

## **Oil and Gas Operations**

Subject Code: 010718

Students will develop the skills applicable to careers in petroleum, natural gas and coal industries. They will learn practices related to exploration, leasing, surveying, drilling, geophysical logging and completion process. Students will be familiar with wellhead and surface production equipment and interpret production histories and graphs. Students will learn sampling, analysis, monitoring and control techniques for effective environmental management in the extractive industries and the principals of metering, sales and marketing.

## **Operations Management**

Subject Code: 142020

Students will learn to plan, organize, and monitor day-to-day business activities. They will use technology to plan production activities, forecast inventory needs, and negotiate vendor contracts. Students will also calculate break-even, set cost-volume-profit goals, and develop policies and procedures to promote workplace safety and security. They will design sustainability plans and use lean and six sigma principles to plan for quality improvement. Corporate social responsibility, ethics, risk management, and compliance will be emphasized.

## **Pre-Engineering Technologies**

Subject Code: 175015

Students in the pre-engineering programs acquire knowledge and skills in problem solving, teamwork and innovation. Students explore STEM careers as they participate in a project-based learning process, designed to challenge and engage the natural curiosity and imagination of middle school students. Teams design and test their ideas using modeling, automation, robotics, mechanical and computer control systems, while exploring energy and the environment.

## **Solar and Wind Energy**

Subject Code: 010717

Students will specify system options by conducting Energy Site Assessments by using and interpreting resource maps, performance data, zoning requirements and interferences, installation timelines and price. Students will read plans, lay out components and assemble electrical systems. Students will perform system checkouts and interpret results from mechanical and electrical diagnostic reports and compile and maintain system records. Students will apply safety regulations and requirements and identify and mitigate public safety issues during system installations.