# Agricultural & Industrial Power Technology
Subject Code: 010210
Course & Unit Description

## Course Description:
The A&I *Power Technology* course will introduce students to the breadth of the Agricultural and Industrial Power Technology pathway. Students will learn the principles of agricultural and industrial power technology equipment systems including electronic, electrical, engines, fuel, hydraulics, and power trains. Additionally, students will learn to operate and maintain agricultural & industrial equipment.

## Unit: Safety

Students will demonstrate their knowledge of safety rules, regulations and identify safety signs and signals. Students will describe health and safety practices and demonstrate appropriate responses for major types of hazardous materials disasters and how identify potential hazards and their prevention.

**Benchmark: 4.1 Safety Procedures**
**Level 2:** Follow safety procedures in specific situations with specialized tools and equipment, evaluate the situation, and take corrective action.

**Indicators**
4.1.01 Demonstrate knowledge of safety rules and regulations
4.1.02 Interpret safety signs and symbols
4.1.03 Model safe attitudes and behaviors (e.g., lifting, climbing)
4.1.04 Identify safety hazards and take corrective measures
4.1.05 Use safety equipment in accordance with established procedures
4.1.06 Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary

**Academic Standards**
English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

## Unit: Equipment Operation

Students learn not only equipment operator responsibilities, but career opportunities and safety principles associated with the operation of machinery.

**Benchmark: 4.3 Equipment Operation**
**Level 2:** Inspect and safely operate specialized equipment with some limitations to adjustments and functions.

**Indicators**
4.3.01 Follow manufacturer's recommended operating procedures and adjustment specifications
4.3.02 Describe function, limitations, and proper use of equipment, equipment controls and instrumentation
4.3.03 Perform pre-operation inspection and adjustments
4.3.04 Perform appropriate start-up, operating and shut-down procedures
4.3.05 Identify, select and exhibit the desired application of hand and power tools
4.3.06 Perform post-operating inspection and adjustments

**Academic Standards**

English: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

Math: Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Mathematical Processes B, 8-10)

## Unit: Equipment Maintenance

Students will perform inspection procedures and proper maintenance on machinery. Students will check and inspect basic electrical systems, engine compartment area, tires and wheel, all fluid levels and chassis and undercarriage systems.

**Benchmark: 4.2 Stationary and Mobile Equipment Maintenance**

**Level 2:** Inspect and maintain specialized machinery and equipment according to schedule.

**Indicators**

4.2.01 Perform a machine condition inspection
4.2.02 Lubricate machinery and equipment
4.2.03 Ensure presence and function of safety systems and hardware
4.2.05 Perform machine adjustments (e.g., belts, clippers, drive chains)
4.2.06 Service filtration systems
4.2.07 Identify, select and maintain fluid levels
4.2.10 Conduct preventative maintenance and identify causes of malfunctions and failures
4.2.13 Maintain lifting equipment (e.g., cranes, chains, slings)

**Academic Standards**

English: Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)

Math: Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Mathematical Processes B, 8-10)

**Benchmark: 4.4 Engines**

**Level 2:** Diagnose and repair components of both small and large internal combustion engines.

**Indicators**

4.4.06 Classify and select engine lubricants, cooling agents and fuels
4.4.12 Evaluate engine components to determine serviceability according to manufacturer's specifications

**Academic Standards**

English: Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)

Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)

Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

## Unit: Engines

Students will demonstrate their knowledge on combustion engines. Design, operating principles and maintenance will be emphasized. Measurements of power and power source selection will be taught.

**Benchmark: 4.4 Engines**
**Level 2:** Diagnose and repair components of both small and large internal combustion engines.

**Indicators**
4.4.01 Locate name plate and determine engine specifications
4.4.02 Analyze and troubleshoot engine
4.4.04 Describe features, benefits and applications of engine types
4.4.05 Describe physical and mechanical principles of engine operation (i.e., motion, friction, thermodynamics)
4.4.07 Identify and service/repair fuel/air system components
4.4.08 Identify and service/repair ignition, starting and charging system components
4.4.09 Identify and service/repair cooling system components
4.4.10 Identify and service/repair lubrication system components
4.4.11 Identify and service/repair electronic control system
4.4.12 Evaluate engine components to determine serviceability according to manufacturer's specifications

**Academic Standards**
English: Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

## Unit: Hydraulics

Students are taught the components and functions of hydraulic and pneumatic systems. Topics include standard symbols, pumps, control valves, control assemblies, actuators, maintenance procedures, and switching and control devices.

**Benchmark: 4.6 Hydraulic Systems**
**Level 2:** Diagnose, repair and rebuild hydraulic components.

**Indicators**
4.6.01 Describe physical and mechanical principles of hydraulics
4.6.02 Describe features, benefits and applications of types of hydraulic and hydrostatic systems
4.6.04 Describe the application and operation of major components (e.g., pumps, motors, valves, cylinders, accumulators)
4.6.08 Evaluate system cleanliness
4.6.12 Adhere to contamination control procedures

**Academic Standards**
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

## Unit: Electrical Systems

Students test and diagnose electrical systems by using tools and instruments (e.g. hydrometers, digital multi-meters, ignition analyzers, generator-alternator-regulator tester).

**Benchmark: 4.7 Electrical and Electronic Systems**
**Level 2: Diagnose** and repair electrical systems.

**Indicators**
4.7.01 Interpret symbols and wiring diagrams
4.7.02 Analyze, diagnose and test electrical systems and components (e.g., charging, starting, lighting, accessories, ignition systems)
4.7.04 Utilize electrical testing equipment
4.7.07 Describe features, benefits and applications of electrical systems
4.7.11 Utilize an onboard diagnostic system

**Academic Standards**
English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Math: Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations. (Algebra D, 8-10)
Science: Apply principles of forces and motion to mathematically analyze, describe and predict the net effects on objects or systems. (Physical Sciences D, 11-12)

## Unit: Welding

This unit introduces students to arc, oxyfuel welding and cutting. Students will learn the fundamental principles of joining ferrous and non-ferrous metals, welding and cutting processes, equipment operation, and safety procedures.

**Benchmark: 4.16 Fabricating Metal with Heat**
**Level 2:** Join and cut ferrous metals using oxyfuel, shielded metal arc and gas shielded metal arc.

**Indicators**
4.16.01 Compare and contrast metal welding operating characteristics and performance (e.g., oxyfuel, shielded metal arc, gas metal arc, flux core arc welding, gas tungsten arc welding, plasma gas, air carbon arc)
4.16.02 Determine properties, types and uses of metal
4.16.03 Classify, select, handle and store electrodes and match to job requirements based on level of penetration desired and heat range
4.16.05 Identify and select the joint design and welding position
4.16.08 Set up welding equipment (e.g., oxyfuel, shielded metal arc, gas metal arc, flux core arc welding, gas tungsten arc welding, plasma arc, air carbon arc)
4.16.09 Solder, braze and braze weld metals
4.16.10 Use shielded metal-arc welding to join and wearface metals
4.16.11 Use gas shielded metal-arc welding to join metals
4.16.12 Cut metals using heat (e.g., plasma arc cutting, air carbon cutting, machine-guided oxyfuel)

**Academic Standards**
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance (Physical Sciences C, 9-10)

**Benchmark: 4.17 Fabricating with Cold Metals**
**Level 2:** Cut, shape, form and join metal stock.

**Indicators**
4.17.01 Lay out, cut and shear metal
4.17.02 Shape stock by bending, folding, cutting, drilling and filling
4.17.07 Process cold metals by tapping, threading, drilling, torquing, smoothing
4.17.08 Analyze surface condition and select and apply abrasives and fillers
4.17.09 Contrast surface coatings and apply them under appropriate environmental conditions

**Academic Standards**
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Describe the identifiable physical properties of substances (e.g., color, hardness, conductivity, density, concentration and ductility). Explain how changes in these properties can occur without changing the chemical nature of the substance. (Physical Sciences C, 9-10)

## Unit: Steering, Suspension and Traction

Students will work with suspension systems components, steering systems, wheel bearings, alignment angles, adjustments and correction, wheel balance and factors contributing to vehicle handling and tire wear.

**Benchmark: 4.9 Steering, Suspension, and Traction**
**Level 2:** Diagnose and repair steering, braking and suspension systems.

**Indicators**
4.9.01 Evaluate traction, ballasting and weight transfer including towing and trailering systems
4.9.02 Evaluate vehicle stability (i.e., automatic leveling device, center of gravity, roll-over and wheel base)
4.9.03 Analyze, diagnose and test suspension systems
4.9.04 Remove, inspect and replace/repair suspension components
4.9.05 Analyze, diagnose and test steering systems
4.9.07 Analyze, diagnose and test vehicle braking system (e.g., electrical, hydraulic, mechanical, pneumatic)
4.9.08 Remove, inspect and replace/repair braking system components

**Academic Standards**
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

## Unit: Heating and Air Conditioning

Students are taught the current state of HVAC technology, theory, and safety. Students learn the principles of thermodynamics, energy, and matter and how those concepts apply to refrigeration. Students are instructed in the use of applicable HVAC tools and equipment.

**Benchmark: 4.8 Heating and Air Conditioning Systems**
**Level 2: Diagnose** and repair vehicle heating and air conditioning systems.

**Indicators**

4.8.01 Apply physical and mechanical principles of heating and cooling to HVAC systems
4.8.02 Evaluate performance of heating and air conditioning systems
4.8.03 Interpret symbols and diagrams
4.8.04 Describe features, benefits and applications of manual and electronically controlled HVAC system
4.8.05 Analyze, diagnose and test heating and air-conditioning system components* *MACS Certification required
4.8.06 Remove, inspect and replace heating and air-conditioning components* *MACS Certification required
4.8.07 Evacuate and select refrigerant to charge air conditioning systems* *MACS Certification required

**Academic Standards**

English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Explain how energy may change form or be redistributed but the total quantity of energy is conserved. (Physical Sciences F, 9-10)

## Unit: Power Transmissions

Students are taught the basic transmission/transaxle theory, inspection, and service procedures. Topics include: general transmission and transaxle diagnosis; transmission and transaxle maintenance and adjustment; in-vehicle transmission and transaxle repair.

**Benchmark: 4.5 Transmission of Power**
**Level 2:** Diagnose and repair power train components.

**Indicators**

4.5.09 Describe features, benefits and applications of mechanical power transmission components (e.g., belts, chains, gears, bearings, seals, universals)
4.5.10 Describe physical and mechanical principles of power transfer (e.g., mechanical, hydraulic, pneumatic and electrical)
4.5.11 Describe features, benefits and application of mechanical transmission technologies (i.e., mechanical, hydraulic, pneumatic and electrical)
4.5.12 Remove, inspect and replace/repair power train components

**Academic Standards**

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)