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Curriculum Resources Used: Agricultural Mechanics Fundamentals and Applications

Authors: Ray V. Herren

Last Updated: 2010
(a) General requirements. This course is recommended for students in Grades 10-12.
(b) Introduction. To be prepared for careers in agricultural power, structural, and technical systems, students should attain academic skills and knowledge; acquire technical knowledge and skills related to power, structural, and technical agricultural systems and the workplace; and develop knowledge and skills regarding career opportunities, entry requirements, industry certifications, and industry expectations. To prepare for success, students should have opportunities to learn, reinforce, apply, and transfer their knowledge and technical skills in a variety of settings. This course is designed to develop an understanding of power and control systems as related to energy sources, small and large power systems, and agricultural machinery.
(c) Knowledge and skills.
   (1) The student outlines the employability skills of a successful employee to meet current industry and societal standards. The student is expected to:
      (A) identify career development and entrepreneurship opportunities in the field of power, structural, and technical systems;
      (B) apply competencies related to resources, information, interpersonal skills, problem solving, and critical thinking in power, structural, and technical systems;
      (C) examine licensing, certification, and credentialing requirements to maintain compliance with industry requirements;
      (D) demonstrate knowledge of personal and occupational health and safety practices in the workplace; and
      (E) identify employers' expectations, including appropriate work habits, ethical conduct, legal responsibilities, and good citizenship skills.
   (2) The student develops an improved supervised agriculture experience program as it relates to agriculture, food, and natural resources. The student is expected to:
      (A) plan, propose, conduct, and evaluate entrepreneurship; placement; exploratory; research, either experimental or analytical; improvement; supplementary; laboratory-based; or other identified, supervised agricultural experience as an experiential learning activity;
      (B) apply proper record-keeping skills as they relate to a supervised experience;
      (C) design and use a customized record-keeping system for the individual supervised experience;
      (D) participate in youth leadership opportunities to create a well-rounded experience program in agriculture; and
      (E) produce a challenging approach for a local program of activities in agriculture.
   (3) The student connects power generation to differing energy sources. The student is expected to:
      (A) discuss benefits and detriments of petroleum and alternative energy sources;
(B) compare environmental impacts of varying energy sources;
(C) compare efficiency and characteristics of different energy sources; and
(D) discuss the efficiency of power generation systems that use various energy sources.

(4) The student selects the appropriate tool to perform a given task related to agricultural power systems. The student is expected to:
   (A) select and identify standard tools, equipment, and safety procedures common to power and control applications;
   (B) follow operating instructions of specialized tools and equipment such as micrometers, digital multimeters, and dynameters;
   (C) set up and adjust tools and equipment such as dynameters, flow meters, torque wrenches, lathes, and mills;
   (D) maintain and store tools and equipment common to power and control applications; and
   (E) inventory tools and equipment in a service or maintenance facility.

(5) The student selects, operates, and maintains small engines. The student is expected to:
   (A) describe principles of operation of internal combustion engines and related power systems and parallel them to shared operations and theories in multiple cylinder engines;
   (B) disassemble and reassemble small engines;
   (C) select, maintain, and troubleshoot small engines; and
   (D) research small engine industry certifications.

(6) The student selects, operates, and maintains agricultural machines and equipment. The student is expected to:
   (A) identify and select agricultural equipment for appropriate tasks such as the selection of tillage equipment to obtain a desired result;
   (B) identify and maintain component materials on varying types of machines and equipment such as bearings, hydraulics, seals, chains, and drives;
   (C) ensure the presence and function of safety systems and hardware on machinery and equipment such as guards and shields;
   (D) calibrate metering, monitoring, and sensing equipment on various equipment such as tillage, harvest, transport, and haying; and
   (E) perform pre-operation inspection and appropriate start-up procedures, identify causes of malfunctions and failures, perform scheduled preventive maintenance, and safely operate equipment.

(7) The student selects, operates, and maintains tractors and agricultural power systems. The student is expected to:
(A) select tractors based upon application and power requirements and describe or perform safe operation of tractors in various applications;

(B) maintain intake and exhaust systems, including shrouds, screens, filters, piping, after-coolers, air induction systems, manifolds, exhausts, and mufflers;

(C) select lubricants and apply appropriate lubrication as required by maintenance schedules on varying lubrication systems;

(D) identify and maintain varying fuel systems, power trains, and hydraulic systems used on farm tractors;

(E) explain charging, starting, operating, and igniting direct current electrical systems as well as troubleshoot simple problems with a digital multimeter;

(F) maintain steering and braking systems;

(G) maintain tires and tracks and describe the role of ballasting and traction in farm tractors; and

(H) explain the operation of and maintain liquid and air-cooling systems in tractors.

(8) The student monitors and controls electrical systems as related to agricultural machines and equipment. The student is expected to:

   (A) use various meters and test equipment such as digital multimeters to collect data and troubleshoot electrical systems;

   (B) employ appropriate techniques for applying devices, controls, and grounding in electrical systems;

   (C) employ codes and regulations relevant to varying applications in electrical systems;

   (D) select and apply electric controls such as motor controls, switches, circuit breakers, timers, sensors, and relays; and

   (E) interpret data generated by electrical monitoring systems.

(9) The student implements control systems as related to agricultural machines and equipment. The student is expected to:

   (A) decipher schematic drawings for electrical control systems;

   (B) describe uses of various electrical control system components;

   (C) install control system components such as motor controls, switches, circuit breakers, timers, sensors, and relays and properly use appropriate tools, procedures, and safety practices; and

   (D) identify system performance problems and apply troubleshooting techniques using monitoring devices or troubleshooting devices.

(10) The student describes hydraulic controls and applications as related to agricultural machines and equipment. The student is expected to:

   (A) describe the operation of open and closed center hydraulic systems;
(B) explain the purpose and function of hydraulic controls such as valves, motors, pumps, cylinders, manifolds, and meters; and

(C) create basic hydraulic circuits using a variety of hydraulic controls.

(11) The student describes additional control systems as related to agricultural machines and equipment. The student is expected to:

(A) explain the application of pneumatic systems and controls; and

(B) explain the application of water or other fluid control systems as they apply to power and control systems and their component controls.