Arkansas CTE

Agricultural Power Systems: Grades 10, 11, 12

Adopted 2007

Introduction to Agricultural Power Systems

1.1 Define terminology

1. Prepare a list of terms with definitions 1.1.1

1.2 Examine the importance of agricultural power systems

1. List uses of agricultural power in the production of agronomic crops, including ground maintenance 1.2.1
2. List uses of power systems in horticultural, including ground maintenance 1.2.2
3. List uses of power systems in forestry and natural resources applications, including soil and water management as well as harvesting 1.2.3
4. List kinds of agricultural machinery based on function 1.2.4
5. List kinds of tractors based on wheels, fuel, design, and hitch 1.2.5

1.3 Discuss major historical events in the emergence of modern agricultural power systems

1. List major agricultural mechanization inventions, including planting machine, cotton gin, reaper, steel moldboard plow, and internal combustion engine 1.3.1
2. Research an inventor of agricultural power and/or machinery and prepare a short report for class 1.3.2

1.4 Identify appropriate FFA activities and supervised experiences in agricultural power systems

1. List FFA activities available in agricultural power systems 1.4.1
2. Participate in appropriate FFA career and personal development experiences 1.4.2
3. Plan and/or expand supervised experiences in agricultural power systems 1.4.3
4. Keep records of FFA and supervised experience participation 1.4.4

Safety Considerations in Agricultural Power

2.1 Define terminology

1. Prepare a list of terms with definitions 2.1.1

2.2 Discuss the meaning and importance of safety in agricultural power work

1. Explain the meaning and importance of safety 2.2.1
2. Draw and explain the accident interaction triangle 2.2.2
3. Identify hazards associated with agricultural power 2.2.3
4. Demonstrate power use of appropriate Personal Protective Equipment (PPE) 2.2.4

2.3 Describe the use of Personal Protective Equipment (PPE) in agricultural electricity

1. Identify the safety color coding used in the agricultural mechanics laboratories 2.3.1
2. Inspect an agricultural mechanics laboratory to determine if proper safety colors are being used 2.3.2

2.4 Discuss classes of fire and types of extinguishers

1. List and explain classes of fires 2.4.1
2. List the types of fire extinguishers and explain when and how to use each 2.4.2

Agricultural Power Industry and Careers

3.1 Define terminology

1. Prepare a list of terms with definitions 3.1.1

3.2 Discuss employment opportunities in agricultural power

1. List examples of occupations in agricultural power 3.2.1
2. List jobs and employers in agricultural power in the local area 3.2.2
3. Observe (job shadow) an agricultural power mechanic or technician at work and prepare a report on your observations 3.2.3

3.3 Describe education and experience preparation for agricultural power careers

1. List education and skill preparation needed for entering and advancing in an agricultural power career 3.3.1
2. Identify personal attributes for success in agricultural power careers 3.3.2

Tools, Equipment, and Fasteners Used in Agricultural Power

4.1 Define terminology

1. Prepare a list of terms with definitions 4.1.1

4.2 Discuss tool and equipment needs for agricultural power

1. List and identify common tools and equipment used in agricultural power work 4.2.1
2. Demonstrate proper use of common tools and equipment used in agricultural power work 4.2.2

4.3 Describe tool and equipment care

1. List practices that help maintain good tool condition 4.3.1
2. Demonstrate proper tool and equipment storage 4.3.2

4.4 Discuss fasteners used in agricultural power work

1. List and identify common fasteners used in agricultural power work, including thread-based and non-thread fasteners 4.4.1
2. Demonstrate proper use of fasteners in agricultural power work 4.4.2

Principles of Power and Engine Operation

5.1 Define terminology

1. Prepare a list of terms with definitions 5.1.1

5.2 Discuss the meaning and importance of appropriate physical science concepts

1. Demonstrate the calculations of important concepts associated with engine efficiency, including work, torque, power, and horsepower 5.2.1
2. List and explain the power ratings of an engine including indicated power, brake power, PTO power and drawbar power 5.2.2

5.3 Discuss the role of internal combustion engines in converting chemical energy into mechanical energy

1. Explain the meaning of energy, chemical energy, and mechanical energy 5.3.1
2. List the major internal combustion engine components and the functions of each, including cylinder block, cylinder, piston, cylinder head, connecting rod, and crankshaft 5.3.2
3. Classify internal combustion engines on the basis of fuel and distinguish between the types 5.3.3

5.4 Discuss efficiency of internal combustion engines

1. Explain the concept of efficiency as related to internal combustion engines 5.4.1
2. Identify factors or conditions associated with engine efficiency, including mechanical efficiency 5.4.2

5.5 Explain the role of systems in engine operation

1. List engine systems 5.5.1

Small Engines

6.1 Define terminology

1. Prepare a list of terms with definitions 6.1.1

6.2 Identify features and uses of small engines

1. Explain the meaning and sizes of small engines 6.2.1
2. List and distinguish between small engines based on stroke cycle 6.2.2
3. Distinguish between small engines based on crankshaft placement 6.2.3
4. Distinguish between small engines based on the kinds of cooling systems 6.2.4
5. Locate the nameplate on a small engine and interpret the information provided 6.2.5
6. List uses of small engines in agriculture, horticulture, forestry, and other agricultural applications 6.2.6

6.3 Discuss small engine components, systems, and functions

1. List and identify major components of small engines 6.3.1
2. Identify the systems on small engines, including air, fuel, lubrication, and ignition 6.3.2
3. Explain the functions of the components and systems of small engines 6.3.3

6.4 Describe preventive maintenance service for small engines

1. Explain the meaning and importance of proper preventive maintenance 6.4.1
2. Refer to the operator's or service manual for scheduled preventive maintenance servicing on a small engine 6.4.2
3. Perform selected preventive maintenance jobs on small engines, including servicing the air, fuel, lubrication, and ignition systems 6.4.3

6.5 Discuss the use of troubleshooting to diagnose small engine problems

1. Explain the meaning and importance of troubleshooting 6.5.1
2. Use troubleshooting to identify a problem with a small engine 6.5.2

Fuel Systems

7.1 Define terminology

1. Prepare a list of terms with definitions 7.1.1

7.2 Describe the function and components of fuel systems

1. List the functions of fuel systems for gasoline and diesel engines 7.2.1
2. Identify the components of fuel systems for gasoline and diesel engines 7.2.2
3. Explain the functions of the components of fuel systems 7.2.3
4. Draw a diagram showing major fuel system components of gasoline and diesel engines and indicate the direction of fuel movement in the system 7.2.4

7.3 Discuss the operation of fuel systems

1. Distinguish between gravity feed and force-feed fuel systems 7.3.1
2. Identify the major parts and functions in a carburetor 7.3.2
3. Demonstrate the proper adjustment of a carburetor, including idle speed, idle fuel, and full-loaded fuel adjustment 7.3.3

7.4 Describe how to troubleshoot and service fuel systems

1. List possible causes of carburetor trouble, including poor performance, poor idling, hard starting, poor acceleration, flooding, and excessive fuel use 7.4.1
2. List the steps in removing, cleaning, and replacing the carburetor on an engine 7.4.2
3. List the steps in servicing a fuel filter 7.4.3
4. Identify procedures in bleeding the air from diesel fuel systems 7.4.4
5. List procedures in testing diesel injector nozzles 7.4.5
6. Bleed air from a diesel fuel system 7.4.6

Engine Lubrication Systems

8.1 Define terminology

1. Prepare a list of terms with definitions 8.1.1

8.2 Discuss the meaning and roles of the lubrication system in an engine

1. Explain lubrication and tell why it is important 8.2.1
2. List the roles of lubrication in an engine 8.2.2
3. List the types of lubrication systems used in engines, including circulating splash, internal force feed splash, and full internal force feed 8.2.3
4. Identify the parts and their functions of a lubrication system 8.2.4
5. Explain the importance of the oil pressure regulating valves 8.2.5

8.3 Discuss servicing the lubrication system of an engine

1. List the functions performed when servicing a lubrication system, including changing the oil and replacing the filter 8.3.1
2. Check oil fill level in an engine by properly using a dipstick 8.3.2
3. Identify different kinds of oil and oil additives 8.3.3
4. List the steps in changing the oil in an engine 8.3.4
5. Demonstrate the ability to clean and replace a crankcase breather 8.3.5
6. Locate information on the lubrication system of an engine in the operator's or service manual 8.3.6
7. Properly dispose of used oil, filters, and other wastes 8.3.7

Cooling Systems

9.1 Define terminology

1. Prepare a list of terms with definitions `9.1.1`

9.2 Discuss the meaning and functions of the cooling system

1. List the functions of the cooling system `9.2.1`
2. Distinguish between the two types of cooling systems (air and liquid) `9.2.2`
3. Identify the major components of liquid cooling systems `9.2.3`
4. Check coolant level in a cooling system `9.2.4`

9.3 Discuss servicing liquid cooling systems

1. List reasons for servicing cooling systems `9.3.1`
2. Identify procedures in servicing a liquid cooling system `9.3.2`
3. Demonstrate the process of draining and replacing coolant `9.3.3`
4. Inspect/adjust fan belt tension as needed `9.3.4`
5. Inspect/replace hoses as needed `9.3.5`
6. Test/replace the cooling system thermostat, if needed `9.3.6`
7. Inspect/clean radiator and cap `9.3.7`
8. Test radiator pressure with tester `9.3.8`
9. Properly dispose of used fluids/wastes `9.3.9`

Electrical Systems

10.1 Define terminology

1. Prepare a list of terms with definitions `10.1.1`

10.2 Discuss the meaning and functions of the electrical system of an engine

1. List the uses of electricity on an engine and a tractor `10.2.1`
2. Identify the major components of an electrical system and the functions of each `10.2.2`
3. Describe the basic circuits of an electrical system `10.2.3`
4. Describe the role and function of a battery `10.2.4`

10.3 Describe service practices on electrical systems

1. Use a diagnostic instrument to electronically check the performance of an electrical system `10.3.1`
2. Check, clean, and otherwise service the battery and connecting terminals of an engine `10.3.2`
3. Check, clean, adjust, and/or replace the spark plugs in an engine `10.3.3`
4. Check and service/replace the coil on an engine `10.3.4`
5. Check and service/replace the distributor, condensor, and breaker points on an engine `10.3.5`
6. Check/service the generator or alternator on an engine `10.3.6`

Transmission Systems

11.1 Define terminology

1. Prepare a list of terms with definitions `11.1.1`

11.2 Discuss the meaning, components, and functions of a power train

1. Identify the major components of a power train `11.2.1`
2. Explain the functions of the components of a power train `11.2.2`
3. List common kinds of transmissions `11.2.3`
4. Identify the importance of lubrication with power trains `11.2.4`
5. Explain the meaning of gear ratio and why it is important `11.2.5`

11.3 Describe service practices with transmissions

1. List routine transmission service procedures `11.3.1`
2. Demonstrate how to check the fluid level `11.3.2`
3. Add and/or replace fluid in a transmission `11.3.3`
4. Use an owner's/service manual to identify and carry out practices with specific manufacturer brands of transmissions `11.3.4`
5. Explain how to clean and maintain the exterior surfaces of a power train housing `11.3.5`

Troubleshooting

12.1 Define terminology

1. Prepare a list of terms with definitions `12.1.1`

12.2 Discuss the meaning and importance of troubleshooting

1. Explain the importance of troubleshooting in identifying engine problems `12.2.1`

12.3 Describe troubleshooting procedures

1. Identify troubleshooting steps if an engine will not start or is hard to start 12.3.1
2. Identify troubleshooting steps if an engine starts but will not run 12.3.2
3. Identify troubleshooting steps if an engine misses 12.3.3
4. Identify troubleshooting steps if an engine detonates and/or pre-ignites 12.3.4
5. Identify troubleshooting steps if an engine backfires and/or knocks 12.3.5
6. Identify troubleshooting steps if an engine overheats 12.3.6
7. Identify troubleshooting steps if an engine lacks power 12.3.7
8. Identify troubleshooting steps if an engine uses too much oil or has low or high oil pressure 12.3.8

Machinery Management

13.1 Define terminology

1. Prepare a list of terms with definitions 13.1.1

13.2 Discuss the meaning and importance of tracor and machinery cost

1. Identify the costs associated with agricultural machinery 13.2.1
2. Explain depreciation and calculate examples 13.2.2
3. List factors that affect operating cost 13.2.3

13.3 Discuss the role of tractor and machinery management in cost

1. Explain the overall goal of tractor and machinery management; i.e., keeping costs low 13.3.1
2. Identify management decisions in keeping costs down, including speed, hitching, engine tuning, rolling resistance and slipping 13.3.2
3. Explain the role of tractor weight in cost management, including the addition of weight 13.3.3
4. Identify the roles of tractor and machinery storage and maintenance in cost 13.3.4