Course Title: Two- and-Four Stroke Engines

Unit 1:	**Careers**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 1. Compare job characteristics of various career opportunities in the power equipment industry.

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Understand the vast scope of careers in the power equipment sector. 2. Determine how power equipment knowledge may be used to earn a living. 3. Identify career opportunities in the power equipment field. 4. Discuss working conditions. 5. Compare benefits in the power equipment field for workers. 6. Fill out job applications and write résumés. 7. Discuss the history of the power equipment industry. 8. Identify mechanical skills that can be used in equipment repair. 9. Describe the relationship between mechanical applications and success in agricultural occupations.

Essential Question(s):	What jobs can you think of in the power equipment industry besides a mechanic?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Mechanical knowledge requirements II. Work place skills III. Business management skills IV. Tool knowledge	Lecture Worksheets Textbook examples Demonstrations Student research Student practice	Textbooks Handouts PowerPoint Computer/projector Guest speaker

Unit Assessment:	Presentation of careers to class

Unit/Course CTSO Activity:	FFA Small Engines Career Development Event (CDE), FFA Agricultural Mechanics CDE

Unit/Course Culminating Product:	Students will gain knowledge of career opportunities in the power equipment industry.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
□ Other:

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Unit 2:	**Safety**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 2. Explain safety procedures for working with power equipment systems

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Explain the meaning of safety. 2. Identify high hazard areas. 3. Explain and demonstrate the use of appropriate personal protective equipment. 4. Demonstrate and explain general hand- and power-tool safety. 5. Recall general shop rules to be followed while in the shop. 6. Explain shop safety color-coding system. 7. Demonstrate knowledge of fire prevention and control methods.

Essential Question(s):	What are the legal and social reasons for learning to prevent shop accidents?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Meaning/Importance of shop safety II. High hazard areas III. Personal Protection Equipment IV. Hand and Power Tool Safety V. Shop Rules VI. Safety Colors VII. Fire Safety	Lecture/demonstration Worksheets Laboratory/shop safety tour Hazard identification tour Safe tool operation demonstration Pretest/Posttest	Guest speaker PowerPoint/ Projector Textbooks Quizzes Web sites Handouts Hand and power tools Videos MSDS PPE Safety Posters

Unit Assessment:	Participation in class discussion, participation in shop hazard identification, and shop safety test (100% mastery)

Unit/Course CTSO Activity:	Incorporate safety practices into student's SAE project.

Unit/Course Culminating Product:	Students will master shop safety by identifying mock safety hazards in the shop and by passing the safety portion of the lesson with a 100 on the shop safety test.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
☐ Other:

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Unit 3:	**Tools**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 3. Identify specific tools used on small engines.

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Identify tools and instruments used for troubleshooting engine problems. 2. Identify tools and instruments used for general maintenance and repair of two- and-four stroke engines. 3. Identify tools and instruments used for disassembly, measuring, and reassembly on engines.

Essential Question(s):	What are the start up costs related to purchasing tools for starting a small engine repair shop? What tools are needed to start a small engine repair shop?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Identify tools used in small engine repair II. Proper use of each tool	Tool identification demonstration Proper use demonstration	Small engine repair tools Engines

Unit Assessment:	Students will participate in tool identification and use tools to troubleshoot and repair engines.

Unit/Course CTSO Activity:	Preparation for Small Engine and Agricultural Mechanics CDE Knowledge of tools for SAE projects

Unit/Course Culminating Product:	Properly identify and use small engine repair tools to troubleshoot and repair small engines.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
□ Other:

Course Title: Two- and-Four Stroke Engines

Unit 4:	**Four-Stroke Engines**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 4. Explain the theory of operation for four-stroke engines. 5. Identify parts of a four-stroke engine. • Diagnosing mechanical system problem in a four-stroke engine • Solving mechanical system problems in a four-stroke engine 6. Explain how the ignition system works in a four-stroke engine. • Diagnosing ignition system problems in a four-stroke engine • Solving ignition system problems in a four-stroke engine 7. Explain how the fuel system works in a four-stroke engine. • Diagnosing fuel system problems in a four-stroke engine • Solving fuel system problems in a four-stroke engine

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Explain how four-stroke engines operate. 2. Identify all the systems in a small engine. 3. Recognize important terms associated with four-stroke engines. 4. Maintain four-stroke engines. 5. Troubleshoot engine problems. 6. Rebuild and recondition four-stroke engines.

Essential Question(s):	What role do four-stroke engines play in lawn maintenance? Lack of maintenance can lead to what issues with four-stroke engines?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Basic engine operation II. Systems of four-stroke engines A. ignition B. fuel C. lubrication D. cooling III. Engine parts and terms IV. Basic maintenance of small engines V. Troubleshooting VI. Rebuilding and reconditioning	Classroom lecture/demonstration Shop demonstration Textbook activities Worksheets Student group work	Textbooks PowerPoint Small engine tools Worksheets Quizzes Videos

Unit Assessment:	Participation in group activities, participation in shop activities, identification of engine parts and terms

Unit/Course CTSO Activity:	Preparation for small engine CDE

Unit/Course Culminating Product:	Master four-stroke engine operation through identification of parts and terminology, successful troubleshooting and repair, and reconditioning.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
☐ Other:

Course Title: Two- and-Four Stroke Engines

Unit 5:	**Two-Stroke Engines**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 8. Explain the theory of operation for two-stroke engines. 9. Identify parts of a two-stroke engine. • Diagnosing mechanical system problems in a two-stroke engine • Solving mechanical system problems in a two-stroke engine 10 Explain how the ignition system works in two-stroke engines. • Diagnosing ignition system problems in a two-stroke engine • Solving ignition system problems in a two-stroke engine 11. Explain how the fuel system works in two-stoke engines. • Diagnosing fuel system problems in a two-stroke engine. • Solving fuel system problems in a two-stroke engine.

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Explain how two-stroke engines operate. 2. Identify all the systems in a two-stroke engine. 3. Recognize important terms associated with two-stroke engines. 4. Maintain small, two-stroke engines. 5. Troubleshoot engine problems. 6. Rebuild and recondition two-stroke engines.

Essential Question(s):	What role do two-stroke engines play in lawn maintenance? Lack of maintenance can lead to what issues with two-stroke engines?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Basic engine operation II. Systems of two-stroke engines A ignition B. fuel C. cooling D. lubrication III. Engine parts and terms IV Basic maintenance of small engines V. Troubleshooting VI Rebuilding and reconditioning	Classroom lecture/demonstration Shop demonstration Textbook activities Worksheets Student group work	Textbooks PowerPoint Small engine tools Worksheets Quizzes Videos

Unit Assessment:	Participation in group activities, participation in shop activities, identification of engine parts and terms

Unit/Course CTSO Activity:	Preparation for small engine CDE

Unit/Course Culminating Product:	Master four-stroke engine operation through identification of parts and terminology, successful troubleshooting and repair, and reconditioning.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
□ Other:

Course Title: Two- and-Four Stroke Engines

Unit 6:	**Cooling Systems**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 12. Identify air and liquid cooling system components and their functions. • Explain the process and need for draining and replacing coolants • Diagnosing cooling system problems in small engines • Solving cooling system problems in small engines

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Explain how air cooling, exhaust cooling, and water cooling work to lower engine operating temperatures. 2. Define the basic function of a water pump and give examples of several common types. 3. Explain the function of a thermostat.

Essential Question(s):	Why are cooling systems vital to an engines operation?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Techniques for draining and changing coolants in liquid cooled engines. II. Troubleshoot problems with air and liquid cooled engines.	Teacher lecture/demonstration Guided practice Group work based learning	Engines Cooling system parts Textbooks Worksheets PowerPoint

Unit Assessment:	Participation in discussion and demonstrations, participation and mastery of assignments related to cooling systems

Unit/Course CTSO Activity:	Preparation for FFA Small Engine CDE

Unit/Course Culminating Product:	Master cooling system operation through identification of parts and terminology, ability to service and maintain small engine cooling systems.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
□ Other:

Course Title: Two- and-Four Stroke Engines

Unit 7:	**Preventive Maintenance**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 13. Identify preventive maintenance procedures for servicing small engines.

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Be able to keep engines clean. 2. Change the oil in a four-stroke engine. 3. Mix fuel and oil correctly for a two-cycle engine. 4. Perform preventive maintenance on various engine systems, including the crankcase breather, air cleaner, and muffler. 5. Prepare a water-cooling system for storage. 6. Describe systematic troubleshooting. 7. Use manufacture's service manuals to determine engine specifications and explain why this information is necessary when servicing a small engine.

Essential Question(s):	What does a little time spent servicing and maintaining an engine help to prevent?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Keeping engines clean and operating. II. Oil A. checking oil B. changing oil III. Fuel and fuel mixes IV Filters A. air filter(s) B. crankcase breather C. oil V. Checking mufflers VII. Carburetion VIII. Storing engines IX. Troubleshooting	Teacher lecture Demonstration(s) Show examples of broken engines and parts. Guided practice Group practice	Engines and examples of broken parts. PowerPoint Computer/projector Textbooks Worksheets Service manuals Small engine tools

A. ignition B. carburetion C. lubrication D. cooling E. compression		

Unit Assessment:	Master techniques for servicing and maintaining small engines through shop based work. (Ex. Changing oils, filters, etc.)

Unit/Course CTSO Activity:	Preparation for FFA Small Engines and Agricultural Mechanics CDEs.

Unit/Course Culminating Product:	Master preventative maintenance of small engines by servicing and maintaining small engines.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
□ Other:

Course Title: Two- and-Four Stroke Engines

Unit 8:	**Engine Overhaul**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 14. Demonstrate procedures for disassembling and cleaning small engines. 15. Demonstrate the procedure for inspecting small engines for wear. • Demonstrating the procedure for measuring engine components 16. Demonstrate the procedure for assembling a small engine according to the manufacture's specifications.

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Inspect engines for problems. 2. Describe procedures for removing engines from implements and cleaning them. 3. List steps involved for engine disassembly. 4. Demonstrate procedures for measuring components. (Ex. Cylinder roundness, pistons, bearings, crankshaft, etc.) 5. List steps involved with reassembly of engines.

Essential Question(s):	When should a small engine mechanic begin to look for engine defects or problems?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Inspect and evaluate engine wear and possible problems. II. Procedures for removing, cleaning, and installing engines on machines and implements. A. tools and materials III. Measure components of the engine to check for wear.	Lecture and demonstration on cleaning, removing, and installing an engine Demonstration on measuring engine components Worksheets and practice problems on reading measuring tools Student group work Guided practice	Textbook Engines Worksheets PowerPoint Computer/projector Small engine tools

Unit Assessment:	Remove, clean, measure and check components, reassemble small engines

Unit/Course CTSO Activity:	Preparation for small engine and agricultural mechanics CDE

Unit/Course Culminating Product:	Master techniques for removing, cleaning, disassembly, measuring and checking components, and reassembly of engines.

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
□ Other:

Course Title: Two- and-Four Stroke Engines

Unit 9:	**Exhaust Systems**

Content Standard(s) and Depth of Knowledge Level(s):	Students will: 17. Explain the operation of an exhaust system on a four-stroke and a two-stroke engine.

Learning Objective(s) and Depth of Knowledge Level(s):	Students will: 1. Explain basic components of the exhaust system of two- and-four stroke engines. 2. Identify procedures for an engine making exhaust. 3. Identify procedures for an engine to dispose of exhaust.

Essential Question(s):	How do engine and exhaust system components in small engines that burn liquefied petroleum, natural gas, kerosene, and diesel fuel differ from typical gas burning engines?

Content Knowledge	**Suggested Instructional Activities Rigor & Relevance Framework (Quadrant)**	**Suggested Materials, Equipment and Technology Resources**
I. Basic exhaust system parts II. Exhaust system terminology III. Adjustment of exhaust system components	Lecture Demonstration Group based work	Engines/exhaust system examples Small engine tools Worksheets Textbook PowerPoint

Unit Assessment:	Participation in exhaust system discussions, lectures, and group oriented shop tasks

Unit/Course CTSO Activity:	Preparation for FFA Small Engine and Agricultural Mechanics CDE

Unit/Course Culminating Product:	Master identification of exhaust system parts and components, and how engine exhaust is produced

Course/Program Credential(s): ☐ Credential ☐ Certificate ☒ Postsecondary Degree ☐ University Degree
□ Other: