# Small Power Systems Course No. 18410 Credit: 1.0

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| --- | --- | --- | --- |
| **Student name:**  |  | **Graduation Date:** |  |

Pathways and CIP Codes:Agricultural Technology and Mechanical Systems (01.0201); Diversified Agricultural Science (01.0000)

Course Description: Courses provide students with the opportunity to learn how to service & recondition small engines, typically emphasizing two and four-cycle engines. Courses provide student with opportunities to troubleshoot and repair speed controls, lubrication, ignition, fuel, power transfer, cooling, exhaust, and starting systems; use hand, power, and overhaul tools; and read and interpret service manuals and parts’ catalogs. Applications may include lawn mowers, tractors, tillers, power tools

Directions:The following competencies are required for full approval of this course. Check the appropriate number to indicate the level of competency reached for learner evaluation.

**RATING SCALE:**

4. Exemplary Achievement: Student possesses outstanding knowledge, skills or professional attitude.

3. Proficient Achievement:Student demonstrates good knowledge, skills or professional attitude. Requires limited supervision.

2. Limited Achievement:Student demonstrates fragmented knowledge, skills or professional attitude. Requires close supervision.

1. Inadequate Achievement:Student lacks knowledge, skills or professional attitude.

0. No Instruction/Training:Student has not received instruction or training in this area.

**Prerequisite: either 18001 – Introduction to Agricultural or 18002 - Agriscience**

## Benchmark 1: Career Options in Small Gas Engines

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 1.1 | Identify and contact career opportunities in the small power systems field.  |  |
| 1.2 | List the qualities that are essential for anyone pursuing a career in small engines.  |  |
| 1.3 | List the advantages and disadvantages of entrepreneurship.  |  |
| 1.4 | Identify the benefits of outdoor power equipment certification.  |  |
| 1.5 | Complete a Resume. |  |

## Benchmark 2: SAFETY IN THE SMALL GAS ENGINE SHOP

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 2.1 | Explain why a clean, well organized shop is extremely important.  |  |
| 2.2 | Identify workplace hazards and the root cause of accidents. |  |
| 2.3 | Explain the importance of maintaining and using tools properly.  |  |
| 2.4 | Identify the safety hazards found in the internal motions of equipment. |  |
| 2.5 | Explain the functions of OSHA.  |  |
| 2.6 | Complete a Shop Safety Contract / Release form. |  |
| 2.7 | Demonstrate knowledge of basic shop safety by satisfactorily completing Safety Exam.  |  |
| 2.8 | Identify types of PPE and their uses in the shop. |  |

## Benchmark 3: TOOLS AND MEASURING INSTRUMENTS

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 3.1 | Explain why quality tools and measuring instruments should be used when servicing small gas engines. |  |
| 3.2 | Use common hand tools properly. |  |
| 3.3 | Demonstrate the ability to use precision measuring techniques with a dial caliper, micrometer, feeler gauge, and a dial indicator to within .002” accuracy.  |  |
| 3.4 | Use a digital multimeter to check continuity, voltage and resistance. |  |

## Benchmark 4: FASTENERS, SEALANTS, AND GASKETS

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 4.1 | Identify fasteners used on small gas engines and implements. |  |
| 4.2 | Remove and install various fasteners correctly. |  |
| 4.3 | Repair or produce internal and external threads.  |  |
| 4.4 | Remove, select, and install gaskets correctly.  |  |

## Benchmark 5: TWO-CYCLE AND FOUR-CYCLE ENGINES

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 5.1 | Describe four-stroke cycle engine operation and explain the purpose of each stroke.  |  |
| 5.2 | Explain the concept of valve timing. |  |
| 5.3 | Compare the lubrication system in a four-cycle engine to the system in a two-cycle engine. |  |
| 5.4 | Describe two-stroke cycle engine operation and explain the principles of two-cycle operation. |  |
| 5.5 | Compare the operation of two-cycle and four-cycle engines. |  |

## Benchmark 6: ENGINE CONSTRUCTION AND PRINCIPLES OF OPERATION

### Competencies

| **#** | **DESCRIPTION** | **RATING** |
| --- | --- | --- |
| 6.1 | Explain simple engine operation and the energy flow through each system.  |  |
| 6.2 | List the qualities of gasoline that make it an efficient fuel for small engines.  |  |
| 6.3 | Explain why gasoline is atomized in the small engine.  |  |
| 6.4 | Identify the basic components of a small engine and describe the function of each part.  |  |

## Benchmark 7: MEASURING ENGINE PERFORMANCE

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 7.1 | Define engine performance. |  |
| 7.2 | Define and compute bore, stroke, displacement, compression ratio, force, work, power, energy, and horsepower.  |  |
| 7.3 | Differentiate between the various types of horsepower. |  |
| 7.4 | Explain the function of a Prony brake and a dynamometer. |  |
| 7.5 | Define and calculate torque. |  |

## Benchmark 8: ENGINE INSPECTION AND DISASSEMBLY

### Competencies

| **#** | **Description** | **RATING** |
| --- | --- | --- |
| 8.1 | Inspect engines for problems.  |  |
| 8.2 | Describe the procedure for removing an engine from an implement. |  |
| 8.3 | Document the steps involved in disassembling an engine using an engine service manual.  |  |
| 8.4 | Measure cylinder conditions such as wear and out-of-roundness.  |  |
| 8.5 | Summarize the reasons for honing a cylinder.  |  |

## Benchmark 9: PISTON AND PISTON RING SERVICE

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 9.1 | Describe piston and piston ring compression.  |  |
| 9.2 | Differentiate between compression rings and oil control rings. |  |
| 9.3 | Explain the purpose of ring end gap. |  |
| 9.4 | Identify common types of piston damage and list possible causes.  |  |
| 9.5 | Explain the purpose of a piston pin. |  |
| 9.6 | Use a leak-down tester to analyze the compression of a small gas engine. |  |
| 9.7 | Demonstrate the ability to remove and replace piston rings. |  |

## Benchmark 10: FUEL AND EMISSION CONTROL SYSTEMS

### Competencies

| **#** | **Description** | **rating** |
| --- | --- | --- |
| 10.1 | Describe the function of the connecting rod and the bearings.  |  |
| 10.2 | Differentiate between friction bearings and antifriction bearings.  |  |
| 10.3 | Summarize the function of the crankshaft. |  |
| 10.4 | Measure and adjust valve clearance to specifications. (OHV engines). |  |
| 10.5 | Explain the operation of ports, reeds, and rotary valves in 2-stroke engines.  |  |
| 10.6 | Describe the purpose of the camshaft. |  |
| 10.7 | Explain the purpose of an automatic compression release.  |  |

## Benchmark 11: FUEL AND EMISSION CONTROL SYSTEMS

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 11.1 | Name various types of fuel that can be used in a small engine and list practical applications for each. |  |
| 11.2 | Explain the importance of proper fuel-oil mixture in a two-cycle engine.  |  |
| 11.3 | Measure the alcohol content of gasoline mixtures. |  |
| 11.4 | Compare the operation of gasoline and diesel fuel systems. |  |
| 11.5 | Describe how renewable resources are used to provide fuel for engines. (Ethanol, biodiesel, etc.). |  |
| 11.6 | Explain fuel pump operation. |  |
| 11.7 | Describe the operation of a pressurized fuel system.  |  |
| 11.8 | Explain the importance of emission control. |  |

## Benchmark 12: CARBURETION

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 12.1 | Explain the parts of a carburetor and their function. |  |
| 12.2 | Identify the three basic types of carburetors. |  |
| 12.3 | Explain float-type carburetor operation.  |  |
| 12.4 | Explain the operation of the diaphragm-type carburetors.  |  |
| 12.5 | Explore the different systems in a carburetor, i.e – idle, choke, high speed, etc.  |  |
| 12.6 | List the basic functions of a governor. |  |
| 12.7 | Describe the purpose of an air cleaner.  |  |

## Benchmark 13: FUEL SYSTEM SERVICE

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 13.1 | Test a fuel pump for proper operation.  |  |
| 13.2 | Summarize basic carburetor adjustments. |  |
| 13.3 | Explain basic procedures for inspecting, overhauling, and adjusting diaphragm and float-type carburetors.  |  |
| 13.4 | Troubleshoot float-type and diaphragm-type carburetors. |  |

## Benchmark 14: IGNITION SYSTEM

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 14.1 | List the primary purposes of the ignition system. |  |
| 14.2 | Identify the components in a typical magneto system and describe the function of each part. |  |
| 14.3 | Describe small engine ignition advance systems.  |  |
| 14.4 | List the advantages of a solid state ignition system. |  |
| 14.5 | Describe the operation of a battery ignition system.  |  |

## Benchmark 15: IGNITION SYSTEM SERVICE

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 15.1 | Examine spark plug deposits for signs of abnormal combustion. |  |
| 15.2 | Clean, gap, and install spark plugs correctly.  |  |
| 15.3 | Explain the basic inspections and tests used to verify proper ignition system operation.  |  |
| 15.4 | Explain basic tests for solid state ignition systems. |  |
| 15.5 | Explain typical service procedures for battery ignition systems. |  |

## Benchmark 16: LUBRICATION SYSTEMS

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 16.1 | Define friction and explain how it affects the internal engine components.  |  |
| 16.2 | List the functions of lubricating oil.  |  |
| 16.3 | Differentiate between the lubrication systems in two-cycle engines and four-cycle engines. |  |
| 16.4 | Explain the operation of ejection pumps, barrel pumps, and positive displacement pumps.  |  |

## Benchmark 17: COOLING SYSTEMS

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 17.1 | Explain how air cooling, exhaust cooling, and water cooling work to lower engine operating temperatures.  |  |
| 17.2 | Define the basic function of a water pump and give examples of several common types. |  |
| 17.3 | Explain the function of a thermostat and a radiator.  |  |

## Benchmark 18: PREVENTIVE MAINTENANCE AND TROUBLESHOOTING

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 18.1 | Change the oil in a four-cycle engine. |  |
| 18.2 | Mix fuel and oil correctly for a two-cycle engine. |  |
| 18.3 | Perform preventive maintenance on various engine systems; including the crankcase breather, air cleaner, and muffler. |  |
| 18.4 | Describe systematic troubleshooting. |  |
| 18.5 | Use manufacturer’s service manuals to determine engine specifications and explain why this information is necessary when servicing a small engine. |  |

## Benchmark 19: ENGINE REASSEMBLY PROCEDURE

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 19.1 | Locate, document, and follow reassembly procedures from an engine service manual. |  |
| 19.2 | Locate part sizes and reject sizes from an engine service manual. |  |
| 19.3 | Look up torque specifications for engine assemblies and parts. |  |
| 19.4 | Assemble engine fasteners and assemblies using the proper torque. |  |
| 19.5 | Start the engine and adjust the top, no-load speed. |  |

## Benchmark 20: ELECTRICAL POWER DRIVE SYSTEMS

### Competencies

| **#** | **Description** | **Rating** |
| --- | --- | --- |
| 20.1 | Discuss electrical power systems for cordless power tools. |  |
| 20.2 | Describe how a battery system works for hybrid electrical vehicles. |  |
| 20.3 | Demonstrate proper safety guidelines for working with electrical battery systems. |  |
| 20.4 | Identify the proper method for disposing of electrical batteries. |  |
| 20.5 | Explain how a hybrid power train works. |  |

I certify that the student has received training in the areas indicated.

Instructor Signature:

For more information, contact:

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