

Title 7: Education K-12

Part 83: Trades Industrial

2006 Mississippi Curriculum Framework

Secondary Small Engine Repair

(Program CIP: 47.0606 – Small Engine Mechanic and Repairer)

Direct inquiries to

Program Coordinator
Trade and Technical Education
Office of Vocational Education and Workforce
Development
Mississippi Department of Education
P.O. Box 771
Jackson, MS 39205
(601) 359-3940

Jo Ann Watts
Instructional Design Specialist
Research and Curriculum Unit
P.O. Drawer DX
Mississippi State, MS 39762
(662) 325-2510
jaw1@ra.msstate.edu

Additional copies

Research and Curriculum Unit for Workforce Development
Vocational and Technical Education
Attention: Reference Room and Media Center Coordinator
P.O. Drawer DX
Mississippi State, MS 39762
<http://cia.rcu.msstate.edu/curriculum/download.asp>
(662) 325-2510

Published by

Office of Vocational Education and Workforce
Development
Mississippi Department of Education
Jackson, Mississippi 39205

Research and Curriculum Unit for Workforce Development
Vocational and Technical Education
Mississippi State University
Mississippi State, Mississippi 39762

The Mississippi Department of Education, Office of Vocational Education and Workforce Development does not discriminate on the basis of race, color, religion, national origin, sex, age, or disability in the provision of educational programs and services or employment opportunities and benefits. The following office has been designated to handle inquiries and complaints regarding the non-discrimination policies of the Mississippi Department of Education: Director, Office of Human Resources, Mississippi Department of Education, 359 North West Street, Suite 359, Jackson, Mississippi 39201, (601) 359-3511.

Acknowledgments

Writing Team

Jimmie Evans, Ross Collins Career & Technical Center,
Meridian, MS
Steve Britt, Jackson Career Development Center, Jackson,
MS
Toby Smith, East Tallahatchie Vocational Center,
Charleston, MS
Wade Jackson, Williams School, Raymond, MS

RCU Staff

Jo Ann Watts – Instructional Design Specialist

MDE Staff

Sam Davis – Trade and Technical Education Program
Coordinator

Professional Curriculum Advisory Team

Charlie Hinton, Mississippi Engine Company Inc. Jackson,
MS
Chris Kelley, Got-gear Motorsports, Ridgeland, MS
Lee Clark, The Kickstand Inc. Jackson, MS
Bill Wright, The Kickstand Inc., Jackson, MS
Donnie Dungan, Stringers International, Charleston, MS
Rolph Wolfe, Rolph R. Wolfe Farms, Cascilla, MS

Standards in this document are based on information from the following organizations:

Standards and Guidelines for Small Engine Programs

Reprinted with permission from Power Equipment
Technology, copyright © 2003, Equipment & Engine
Training Council, www.eetc.org

Academic Standards

Mississippi Department of Education Subject Area Testing
Program

Workplace Skills for the 21st Century

Secretary's Commission on Achieving Necessary Skills

National Educational Technology Standards for Students

Reprinted with permission from *National Educational
Technology Standards for Students: Connecting
Curriculum and Technology*, copyright © 2000, ISTE
(International Society for Technology in Education),
1.800.336.5191 (U.S. & Canada) or 1.541.302.3777
(International), iste@iste.org, www.iste.org. All rights
reserved. Permission does not constitute an endorsement
by ISTE.

Foreword

Secondary vocational-technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act III, 1998; and No Child Left Behind Act of 2001).

Each secondary vocational-technical course consists of a series of instructional units which focus on a common theme. have been written using a common format which includes the following components:

- Unit Number and Title
- Suggested Time on Task - An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75-80 percent of the time in the course.
- Competencies and Suggested Objectives
 - A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies.
 - The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.
- Suggested Teaching Strategies - This section of each unit indicates strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies which reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.
- Suggested Assessment Strategies - This section indicates strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

- Integrated Academic Topics, Workplace Skills, Technology Standards, and Occupational Standards - This section identifies related academic topics as required in the Subject Area Assessment Program (SATP) in Algebra I, Biology I, English II, and U. S. History from 1877, which are integrated into the content of the unit. It also identifies the general workplace skills as identified in the Secretary's Commission on Achieving Necessary Skills (SCANS) report as being critical for all workers in the 21st Century. In addition, national technology standards and occupational skills standards associated with the competencies and suggested objectives for the unit are also identified.
- References - A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Table of Contents

Acknowledgments.....	3
Foreword.....	4
Program Description.....	7
Course Outline.....	8
Small Engine Repair I.....	10
Unit 1: Safety and Orientation.....	10
Unit 2: Tools and Equipment.....	15
Unit 3: Engine Identification and Inspection.....	19
Unit 4: Basic Engine Principles and Design.....	23
Unit 5: Basic Electricity.....	28
Unit 6: Ignition Systems.....	32
Unit 7: Lubrication Systems.....	36
Unit 8: Cooling Systems.....	40
Unit 9: Fuel Systems (Carburetor-Type).....	44
Small Engine Repair II.....	49
Unit 1: Safety and Orientation (Review and Reinforcement).....	49
Unit 2: Charging Systems.....	54
Unit 3: Governor Systems.....	58
Unit 4: Starting Systems.....	62
Unit 5: Exhaust Systems.....	66
Unit 6: Shop Management.....	70
Unit 7: Employability Skills.....	74
Unit 8: Overhaul of Four-Stroke Cycle Engine.....	78
Unit 9: Overhaul of Two-Stroke Cycle Engine.....	83
Unit 10: Troubleshooting.....	87
Recommended Tools and Equipment.....	91
Student Competency Profile for Small Engine Repair I.....	94
Student Competency Profile for Small Engine Repair II.....	96
Appendix A: Equipment & Engine Training Council Standards for Small Engine Repair.....	98
Appendix B: Academic Standards.....	99
Appendix C: Workplace Skills for the 21 st Century.....	106
Appendix D: National Educational Technology Standards for Students.....	107
Appendix E: Evaluations and Rubrics for Small Engine Repair.....	108
Written Report Evaluation.....	108
Presentation Evaluation.....	109
Role Play or Skit Rubric.....	110
Resume Rubric.....	111
Performance Rubric.....	112

Program Description

Small Engine Repair is an instructional program that generally prepares individuals to repair small internal-combustion engines used on portable power equipment such as lawn mowers, chain saws, rotary tillers, motorcycles, and lawn and garden tractors. Students in Small Engine Repair I complete study in safety, tools and equipment, fasteners, measuring, engine identification and inspection, basic engine principles and design, lubrication systems, cooling systems, fuel systems, basic electricity, and ignition systems. Students in Small Engine Repair II complete study in safety, charging systems, starting systems, exhaust systems, overhaul of four-stroke and two-stroke cycle engines, governor systems, shop management, and troubleshooting.

The content of this curriculum framework is based on national standards as developed by the Equipment & Engine Training Council.

Industry standards are based on the *Equipment & Engine Training Council Standards for Small Engine Repair*.

Course Outline

Small Engine Repair I Course CIP Code: 47.0606

Course Outline: Small Engine Repair I is an instructional program that generally prepares individuals to repair small internal-combustion engines used on portable power equipment such as lawn mowers, chain saws, rotary tillers, motorcycles, and lawn and garden tractors. Students in Small Engine Repair I complete study in safety, tools and equipment, fasteners, measuring, engine identification and inspection, basic engine principles and design, lubrication systems, cooling systems, fuel systems, basic electricity, and ignition systems. (2-2½ Carnegie Units, depending upon time spent in the course)

Unit	Title	Hours
1	Safety and Orientation	10
2	Tools and Equipment	45
3	Engine Identification and Inspection	22.5
4	Basic Engine Principles and Design	22.5
5	Basic Electricity	22.5
6	Ignition Systems	22.5
7	Lubrication Systems	15
8	Cooling Systems	22.5
9	Fuel Systems (Carburetor-Type)	22.5

Small Engine Repair II
Course CIP Code: 47.0613

Course Description: Small Engine Repair is an instructional program that generally prepares individuals to repair small internal-combustion engines used on portable power equipment such as lawn mowers, chain saws, rotary tillers, motorcycles, and lawn and garden tractors. Students in Small Engine Repair II complete study in safety, charging systems, starting systems, exhaust systems, overhaul of four-stroke and two-stroke cycle engines, governor systems, shop management, and troubleshooting. (2-2½ Carnegie Units, depending upon time spent in the course)

Unit	Title	Hours
1	Safety and Orientation (Review and Reinforcement)	10
2	Charging Systems	15
3	Governor Systems	15
4	Starting Systems	15
5	Exhaust Systems	15
6	Shop Management	15
7	Employability Skills	22.5
8	Overhaul of Four-Stroke Cycle Engine	30
9	Overhaul of Two-Stroke Cycle Engine	30
10	Troubleshooting	37.5

Small Engine Repair I
Unit 1: Safety and Orientation

(10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Describe local program and vocational/career technical center policies and procedures.</p> <p>a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.</p>	<p>Teaching:</p> <ul style="list-style-type: none"> • Present local program and vocational/career technical center policies and procedures. • Students will read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. Students will work together in pairs. A student with a higher reading ability will team up with a student with a lower reading ability to get a better understanding of the school's program policies and procedures. Each student will submit a written report on rules and regulations. <p>Assessment:</p> <ul style="list-style-type: none"> • Assess student orientation, policy, and procedure knowledge through instructor observations and written unit test. File completed test to document student mastery of the school and program policies and procedures. • The report will be evaluated for clarity and content using the Written Report Evaluation in Appendix E.
<p>2. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.</p> <p>a. Demonstrate effective teambuilding and leadership skills.</p> <p>b. Practice appropriate work ethics.</p>	<p>Teaching:</p> <ul style="list-style-type: none"> • Discuss the role of a team member and leader. Assign the students roles within a team and have them role play a situation in which there is a conflict which must be resolved. Utilize the lessons from SkillsUSA or other resources to provide additional training. • Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems in the small engine repair profession.

	<p>Assessment:</p> <ul style="list-style-type: none"> Assess the role play using the Role Play or Skit Rubric in Appendix E.
<p>3. Describe general safety rules for working in a shop/lab and industry.</p> <ol style="list-style-type: none"> Describe how to avoid on-site accidents. Explain the relationship between housekeeping and safety. Explain the importance of following all safety rules and company safety policies. Explain the importance of reporting all on-the-job injuries, accidents, and near misses. Explain the need for evacuation policies and the importance of following them. Explain the employer's substances abuse policy and how it relates to safety. Explain the safety procedures when working near pressurized or high temperature. 	<p>Teaching:</p> <ul style="list-style-type: none"> Identify, discuss, and demonstrate terms, rules, and procedures related to shop/lab and industry safety. Required written tests will follow each section of guidelines for safety rules and procedures. Provide the students with a list of terms and have them define the terms. Pair the students to quiz each other on the definitions in preparation for a written exam. Use the guidelines provided for personal safety (i.e. clothing, jewelry, hair, eyes, and ears). Divide the students into pairs and assign each pair one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the guideline. Have an industry speaker present to the class the necessity of safety in the work environment. The students will write a summary of the presentation. NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR. <p>Assessment:</p> <ul style="list-style-type: none"> Student participation will be monitored by the instructor and the written exam will be graded. The student must achieve 100 % accuracy. The "do's and don'ts" exercise will be critiqued with a peer review. The summary of the speaker's presentation will be critiqued using the Written Report Evaluation in Appendix E.
<p>4. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.</p> <ol style="list-style-type: none"> Define terms, categories, and symbols associated with hazardous materials. Describe and identify methods and procedures for storing materials and reducing hazardous waste. 	<p>Teaching:</p> <ul style="list-style-type: none"> Provide students with a list of terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials. Have the students define the terms through the use of printed material and Internet searches.

<ul style="list-style-type: none"> c. Identify and describe the informational sections found on a Material Safety Data Sheet (MSDS). d. Describe general first aid procedures in case of an accident involving hazardous materials. e. Identify safety equipment to be used with hazardous materials. f. Describe steps to follow in handling spills and waste disposal. 	<ul style="list-style-type: none"> • Provide students with a list of the classes (Class 1-9) and signal words or symbols related to hazardous materials including Class 2 Gases, Class 3 Flammable Liquids, and Class 8 Corrosives. Divide the students into pairs or groups; assign each group a class. The group will research information to include first aid procedures, safety equipment, MSDS requirements, and storing materials. The pairs or groups will present the information to the rest of the class. Using the information from their research, the pairs or groups will develop scenarios of hazards and accidents. The pairs or groups will swap scenarios, develop a prevention plan and a treatment program, and present the plan to the rest of the class. <p>Assessment:</p> <ul style="list-style-type: none"> • Assessment will be teacher observation, student participation, a written test, and the Presentation Evaluation in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

Secondary Small Engine Repair

- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools

SUGGESTED REFERENCES

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.

Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.

Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.

Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.

Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.

Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.

Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I
Unit 2: Tools and Equipment

(45 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the safe use and maintenance of tools and equipment.</p> <ol style="list-style-type: none"> Identify and demonstrate the safe use of basic hand tools. Identify the tools used in overhaul of small engines. Describe procedures concerning the maintenance of hand tools. Identify and demonstrate the safe and proper use of lifting and hoisting equipment. Identify and demonstrate the safe use of power equipment. 	<p>Teaching:</p> <ul style="list-style-type: none"> The instructor will review automotive supply catalogs and self-made pictures of tools and equipment that students will use in the program. The instructor will discuss and demonstrate safety procedures, proper use, and storage of tools and equipment. The student will demonstrate safety procedures, proper use, and storage of tools and equipment. A specific task will be assigned to a group of students. The group will make a list of the proper tools that will be required to complete the task and present their decisions to the class. The instructor will explain and demonstrate the use of software for the specific area of instruction. The student will use the software for tool identification. <p>Assessment:</p> <ul style="list-style-type: none"> Assess with a tool identification test. A job sheet will be evaluated for the task, and the Presentation Evaluation in Appendix E will be used. The results from the software test will be printed and evaluated.
<p>2. Identify common fasteners and describe their use.</p> <ol style="list-style-type: none"> Identify the different types of bolts, nuts, and washers and describe their appropriate uses. Identify bolts by grade, diameter, length, and thread pitch. Identify different glues and sealants and describe their appropriate use. Restore internal and external threads. 	<p>Teaching:</p> <ul style="list-style-type: none"> The instructor will explain and show fasteners using catalogs. The instructor will display several models that the students can view and manipulate. The students will analyze the fasteners, apply the proper fasteners, and present the decisions to the class. <p>Assessment:</p> <ul style="list-style-type: none"> The Presentation Rubric in Appendix E will be used for evaluation.
<p>3. Apply measurement procedures used in small engine repair.</p> <ol style="list-style-type: none"> Identify measuring instruments used in small engine repair. Measure the length of an object using 	<p>Teaching:</p> <ul style="list-style-type: none"> The instructor will display and demonstrate measuring tools. The students will practice using the tool to accurately measure given items.

<p>a rule to the nearest 1/16th of an inch and 1 millimeter.</p> <p>c. Measure the inside diameter, outside diameter, and/or depth to the nearest .001 of an inch and nearest .1 millimeter, using precision measuring instruments (micrometers, calipers, and dial indicators).</p>	<ul style="list-style-type: none"> • The instructor will provide a worksheet on measurement. • The instructor will demonstrate how to measure a given item using a variety of measuring instruments. The student will measure given items and record the answers. • The instructor will explain and demonstrate software to review measuring skills. The student will use software to complete worksheets. <p>Assessment:</p> <ul style="list-style-type: none"> • Assessment will be teacher observation. • A worksheet will be graded. • The student will measure given items and record on a job sheet for a grade. • The worksheets will be graded.
--	---

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.

- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.

- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>
- Grounds maintenance*. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>
- Jack's small engines*. Retrieved October 27, 2005, from <http://www.jacksmallengines.com/>
- Kawasaki engines*. Retrieved October 18, 2005, from <http://www.kawpowr.com/>
- Kohler engines*. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>
- Landscape construction magazine*. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>
- Landscape management*. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>
- Lawn and landscape magazine*. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>
- Society of automotive engineers*. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>
- Turf magazine*. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I**Unit 3: Engine Identification and Inspection****(22.5 hours)**

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Identify types of small engines. <ol style="list-style-type: none"> Define new terms associated with engine identification and inspection. Compare and contrast distinguishing characteristics of four-stroke and two-stroke cycle engines. Describe categories of information which can be determined from the operator's instructions and/or inspection of the engine. Complete an engine identification and inspection form according to manufacturer's specifications. 	Teaching: <ul style="list-style-type: none"> Provide a list of terms and have students define them. Discuss the terms and provide a matching activity. Using cut-a-way models, demonstrate the characteristics of four-stroke and two-stroke engines. Have the students discuss the differences between the engines. The instructor will review the text, Internet, manuals, and handouts for locating and applying information. The student will be assigned to locate specific information for an assigned task using text, Internet, manuals, and handouts. Provide the students with a form and have them complete the necessary information. Assessment: <ul style="list-style-type: none"> The matching activity will be graded for accuracy. The information will be recorded on the job sheet. Grade the completed form for accuracy.

STANDARDS*Equipment & Engine Training Council Standards*

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools

SUGGESTED REFERENCES

Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.

- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>
- Grounds maintenance*. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>
- Jack's small engines*. Retrieved October 27, 2005, from <http://www.jacksmallengines.com/>
- Kawasaki engines*. Retrieved October 18, 2005, from <http://www.kawpowr.com/>
- Kohler engines*. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>
- Landscape construction magazine*. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>
- Landscape management*. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>
- Lawn and landscape magazine*. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from
<http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I

Unit 4: Basic Engine Principles and Design

(22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the principles of operation of an internal combustion engine.</p> <ol style="list-style-type: none"> Define terms associated with basic engine principles and design. Describe the parts of a basic internal combustion engine cylinder unit. Describe steps in the process by which an internal combustion engine converts chemical energy into rotary motion. 	<p>Teaching:</p> <ul style="list-style-type: none"> Provide students with a list of terms. Have the students define the terms through the use of printed material and Internet searches. Demonstrate the tear-down of an engine. Discuss throughout the disassembly process the name and function of each part. Provide a display of the major components. Using an activity sheet, the students will identify these components and describe the function of each component. Discuss the process of converting chemical energy to mechanical energy. Provide the students with a handout. Using the diagram of the 4 cycles, have the students label each cycle as chemical or mechanical energy. <p>Assessment:</p> <ul style="list-style-type: none"> Assessment will be a teacher observation, student participation, and written test. The activity sheet will be graded for accuracy. The diagram will be graded for correctness.
<p>2. Analyze engine horsepower rating.</p> <ol style="list-style-type: none"> Read and interpret engine label. Read and interpret manufacturer's service manual to analyze engine horsepower rating. 	<p>Teaching:</p> <ul style="list-style-type: none"> Discuss horsepower rating to include location and meaning. Have the students interpret horsepower rating, using a model engine. <p>Assessment:</p> <ul style="list-style-type: none"> Assessment will be teacher observation of class participation.
<p>3. Explain the principles of four-stroke cycle engine operation.</p> <ol style="list-style-type: none"> Define terms associated with the principles of operation of a four-stroke cycle engine. Identify basic components of a four-stroke cycle engine. Describe the operation of a four- 	<p>Teaching:</p> <ul style="list-style-type: none"> Provide students with a list of terms. Have the students define the terms through the use of printed material and Internet searches. Identify the basic components of the four-stroke cycle engine. Divide the students into pairs or groups. Using materials

<p>stroke cycle engine as related to each stroke of the cycle.</p>	<p>available in the classroom and from the Internet, the students will prepare a presentation describing the function of each part. This presentation will include a written report and visual representation.</p> <p>Assessment:</p> <ul style="list-style-type: none"> • Assessment will be a teacher observation, student participation, and written test. • The presentation will be assessed using the Presentation Rubric and the Written Report Evaluation in Appendix E.
<p>4. Explain the principles of two-stroke cycle engine operation.</p> <ol style="list-style-type: none"> Define terms associated with the two-stroke cycle engine. Identify basic components of a two-stroke cycle engine. Simulate the steps in the operation of a two-stroke cycle. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Provide students with a list of terms. Have the students define the terms through the use of printed material and Internet searches. • Identify the basic components of the two stroke cycle engine. Using materials available in the classroom and from the Internet, the students will research the function of each part. They will draw a representation of each cycle and label the components of the engine. <p>Assessment:</p> <ul style="list-style-type: none"> • Assessment will be a teacher observation, student participation, and written test. • The activity will be assessed by teacher observation and grading the drawing using the Presentation Evaluation in Appendix E.
<p>5. Describe the basic operation principles of a diesel engine.</p> <ol style="list-style-type: none"> Identify and describe the sequence of operation of a four-stroke cycle diesel engine. Compare differences in diesel and gasoline engines. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Using a video or other resource, identify the basic components of the four-stroke cycle diesel engine. Divide the students into pairs or groups. Using materials available in the classroom and from the Internet, the students will prepare a presentation describing the function of each part. This presentation will include a written report with a drawing correctly labeled. • Have the students determine the main differences in diesel and gasoline engines using video, Internet, or text references. Discuss, as a class, the findings of the students relating to the differences of the two engines.

	<p>Assessment:</p> <ul style="list-style-type: none"> The presentation and drawing will be assessed using the Presentation Evaluation in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools

SUGGESTED REFERENCES

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I
Unit 5: Basic Electricity

(22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the principles of basic electricity.</p> <ol style="list-style-type: none"> a. Define terms associated with basic electricity. b. Describe sources of electricity. c. Explain the difference between conductors and insulators. d. Illustrate common electrical symbols used in schematic diagrams. e. Compare the differences between series, parallel, and series/parallel circuits. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Using various resources, define and discuss the terms related to electricity. The students will match terms with the definitions. • Discuss the three sources of electricity and have the students describe each of the sources either written or orally. • Discuss the difference between conductors and insulators. Have the students provide uses of each. • Provide students with a handout of common electrical symbols. Using the handout, have the students label sample schematic diagrams. • Provide students with a handout illustrating an example of a series circuit, parallel circuit, and a series-parallel circuit. Provide the students with a labeling exercise where they have to identify each type of circuit. <p>Assessment:</p> <ul style="list-style-type: none"> • The matching activity will be assessed for accuracy. • The assessment will be teacher observation, student participation, and graded diagrams. • The labeling activity will be assessed for accuracy.
<p>2. Describe instruments and perform measurements of electricity.</p> <ol style="list-style-type: none"> a. Describe instruments used in checking electrical circuits. b. Measure resistance, continuity, amperage, and voltage in parallel, series, and closed circuits. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Display instruments to students and describe each. Using a visual display, students will correctly identify instruments presented. • Demonstrate the correct usage of a multimeter to measure resistance, continuity, amperage, and voltage. Students will practice using the multimeter. Students will perform each operation as a performance activity.

	<p>Assessment:</p> <ul style="list-style-type: none"> • Identification list will be graded for accuracy. • Assessment will be teacher observation and the Performance Rubric in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

OPE3 Electrical

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- A5 Utilize various formulas in problem-solving situations.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.

Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I
Unit 6: Ignition Systems

(22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the components of a small engine ignition system.</p> <ol style="list-style-type: none"> Describe the types of ignition systems. Identify components of a battery, magneto, solid state, and breaker-less ignition system (primary and secondary circuits). Interpret the purpose and operation of ignition system components. Explore trends and changes related to ignition systems. 	<p>Teaching:</p> <ul style="list-style-type: none"> List and define the types of ignition systems. Have the students match the definitions with the types of ignition systems on an activity sheet. Provide students with a handout describing the components of each type of ignition system. Students will be given an example of various types of motors and will match the type of ignition system with each motor. Show a video to describe the purpose and operation of ignition system components. Have the students write a brief report on the video content. Assign students a research report relating to trends and changes. The report may be written or oral. <p>Assessment:</p> <ul style="list-style-type: none"> The matching activity will be graded for accuracy. Report will be assessed with the Written Report Evaluation in Appendix E.
<p>2. Service and test small engine ignition systems.</p> <ol style="list-style-type: none"> Remove, service, and/or replace sparkplugs according to manufacturer's specifications. Remove and replace contact points and condenser according to manufacturer's specifications. Test the coil, condenser, armature, and flywheel magnets according to manufacturer's specifications. Test and adjust a solid state ignition system according to manufacturer's specifications. Perform a coil power test according to manufacturer's specifications. Test condenser for leakage or short according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Following a teacher demonstration of the procedures, the students will perform the removal, service, and/or replacement of sparkplugs. Following a teacher demonstration of the procedures, the students will perform the removal and replacement of contact points and condenser. Following a teacher demonstration of the procedures, the students will test the coil, condenser, armature, and flywheel magnets. Following a teacher demonstration of the procedures, the students will test and adjust a solid state ignition system. Following a teacher demonstration of the procedures, the students will perform a coil power test.

	<ul style="list-style-type: none"> Following a teacher demonstration of the procedures, the students will test a condenser for leakage or short. <p>Assessment:</p> <ul style="list-style-type: none"> Assessment will be the Performance Rubric in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

OPE1 2 & 4 Stroke Gasoline Engines

OPE3 Electrical

OPE4 Compact Diesel

OPE5 Generators

Academic Standards

A1 Recognize, classify, and use real numbers and their properties.

A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.

E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.

E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.

E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

E5 Complete oral and written presentations which exhibit interaction and consensus within a group.

E7 Discover the power and effect of language by reading and listening to selections from various literary genres.

E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.

E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.

E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

WP1 Allocates resources (time, money, materials and facilities, and human resources).

WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

Secondary Small Engine Repair

- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.

Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jacksmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I
Unit 7: Lubrication Systems

(15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the principles of lubrication and engine oils.</p> <ol style="list-style-type: none"> Define terms related to lubrication systems. Describe the characteristics and functions of engine oil. Examine factors to consider in selection and use of oils for best engine performance. 	<p>Teaching:</p> <ul style="list-style-type: none"> Using various resources, define and discuss the terms related to lubrication. The students will match terms with the definitions. Discuss the characteristics and functions of engine oil. Show a video on the functions of engine oil, and have students answer questions concerning video and discussion content. Examine the factors to consider in the selection and use of oils. Assign students a specific model of engine. They will prepare a form that includes the brand of oil which meets manufacturer's specifications, oil change intervals, climatic temperature range, etc. <p>Assessment:</p> <ul style="list-style-type: none"> The matching activity will be assessed for accuracy. The activity will be assessed for accuracy. The form will be assessed for accuracy.
<p>2. Perform lubrication services on small engines.</p> <ol style="list-style-type: none"> Change engine oil and filter (if present). Service a crankcase breather according to manufacturer's specifications. Mix lubricant and fuel for a two-stroke cycle engine according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate how to change engine oil and filter (if present) including replacement or cleaning of oil filter according to manufacturer's specifications. The students will change the engine oil and filter. Demonstrate how to service a crankcase breather according to manufacturer's specifications. The students will service a crankcase breather. Demonstrate how to mix lubricant and fuel for a two-stroke cycle engine according to manufacturer's specifications. The students will mix lubricant and fuel for a two-stroke cycle engine. <p>Assessment:</p> <ul style="list-style-type: none"> Assessment will be the Performance Rubric in Appendix E.

<p>3. Apply procedures for preparing a small engine for storage.</p> <p>a. Prepare a small engine for storage according to manufacturer's specifications.</p>	<p>Teaching:</p> <ul style="list-style-type: none"> • Demonstrate how to prepare a small engine for storage according to manufacturer's specifications. The students will prepare a small engine for storage. <p>Assessment:</p> <ul style="list-style-type: none"> • Assessment will be the Performance Rubric in Appendix E.
---	--

STANDARDS

Equipment & Engine Training Council Standards

OPE2 Drivelines/Hydraulics/Hydrostatics

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

Secondary Small Engine Repair

- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.

Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I
Unit 8: Cooling Systems

(22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Service an air-cooled small engine system.</p> <ol style="list-style-type: none"> Define terms associated with air-cooled cooling systems. Identify components of an air-cooled engine cooling system. Remove, clean, and replace air cooling system parts according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Using various resources, define and discuss the terms related to air-cooled cooling system. The students will match terms with the definitions. Discuss components of an air-cooled engine cooling system. Provide the students with a list of the components and have them determine the function of each component. Demonstrate procedures to remove, clean, and replace air cooling system parts according to manufacturer's specifications. The students will remove, clean, and replace air cooling system parts. <p>Assessment:</p> <ul style="list-style-type: none"> The student's list will be assessed for accuracy. The Performance Rubric in Appendix E will be used to assess the removal, cleaning, and replacement of the air cooling system.
<p>2. Service a liquid-cooled small engine system.</p> <ol style="list-style-type: none"> Identify the parts of a liquid-cooled engine cooling system. Inspect and service a liquid-cooled engine cooling system. 	<p>Teaching:</p> <ul style="list-style-type: none"> Discuss the parts of a liquid-cooled engine cooling system. Provide the students with a list of the components and have them determine the function of each component. Demonstrate procedures to inspect and service a liquid-cooled engine cooling system. The student will inspect and service a liquid-cooled engine cooling system. <p>Assessment:</p> <ul style="list-style-type: none"> The list will be assessed for accuracy. The Performance Rubric in Appendix E will be used to assess the inspection and service of the engine cooling system.

STANDARDS

Equipment & Engine Training Council Standards

OPE2 Drivelines/Hydraulics/Hydrostatics

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.

WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>.
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>
- Grounds maintenance*. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>.

Jack's small engines. Retrieved October 27, 2005, from <http://www.jacksmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>.

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>.

Landscape construction magazine. Retrieved October 21, 2005, from
<http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from
<http://www.landscapemanagement.net/landscape/>.

Lawn and landscape magazine. Retrieved October 21, 2005, from
<http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from
<http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair I
Unit 9: Fuel Systems (Carburetor-Type)

(22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Identify fuel and fuel systems used in small engines.</p> <ol style="list-style-type: none"> a. Identify the components of a typical carburetor-type fuel system. b. Identify the different types of fuel filters. c. Identify the different types of air cleaners. d. Identify the parts of a float-type and diaphragm-type carburetor. e. Describe functions of the carburetor. f. Identify the components and functions of fuel injectors. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Discuss components of an air-cooled engine cooling system. Provide the students with a list of the components and have them determine the function of each component. • List and define the types of fuel filters. Have the students match the definitions with the types of fuel filters on an activity sheet. • List and define the types of ignition systems. Have the students match the definitions with the types of ignition systems on an activity sheet. • Display parts of each carburetor and discuss the different parts. Using a visual presentation, have the students match the parts with their names. • Have the students research the functions of the carburetor using materials in the classroom and Internet. The students will write a report and present either in written or oral form. • Provide students with a handout describing the components and function of each type of fuel injectors. Students will be given an example of various components and will match the function of the fuel injectors with each component. <p>Assessment:</p> <ul style="list-style-type: none"> • The assessment will use the Written Report Evaluation or the Presentation Evaluation in Appendix E. • The matching activity will be assessed for accuracy.

<p>2. Remove, service, replace, and adjust an air cleaner, oil bath cleaner, float-type carburetor, and diaphragm-type carburetor.</p> <ol style="list-style-type: none"> Service an air cleaner (paper element and polyurethane) according to manufacturer's specifications. Service an oil bath air cleaner according to manufacturer's specifications. Remove, service, replace, and adjust a float-type carburetor according to manufacturer's specifications. Remove, service, replace, and adjust a diaphragm-type carburetor according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate procedures to service an air cleaner (paper element and polyurethane) according to manufacturer's specifications. The students will service an air cleaner. Demonstrate procedures to service an oil bath air cleaner according to manufacturer's specifications. The students will service an oil bath air cleaner. Demonstrate procedures to remove, service, replace, and adjust a float-type carburetor according to manufacturer's specifications. The students will remove, service, replace, and adjust a float-type carburetor. Demonstrate procedures to remove, service, replace, and adjust a diaphragm-type carburetor according to manufacturer's specifications. The students will remove, service, replace, and adjust a diaphragm-type carburetor. <p>Assessment:</p> <ul style="list-style-type: none"> Assessment will use the Performance Rubric in Appendix E.
---	---

STANDARDS

Equipment & Engine Training Council Standards

OPE1 2 & 4 Stroke Gasoline Engines

OPE4 Compact Diesel

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.

- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>.
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>
- Grounds maintenance*. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>.
- Jack's small engines*. Retrieved October 27, 2005, from <http://www.jacksmallengines.com/>
- Kawasaki engines*. Retrieved October 18, 2005, from <http://www.kawpowr.com/>.
- Kohler engines*. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>.
- Landscape construction magazine*. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>
- Landscape management*. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>.
- Lawn and landscape magazine*. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from
<http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II

Unit 1: Safety and Orientation (Review and Reinforcement)

(10 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Describe local program and vocational/career technical center policies and procedures.</p> <p>a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations.</p>	<p>Teaching:</p> <ul style="list-style-type: none"> • Present local program and vocational/career technical center policies and procedures. • Students will read the handbook to become aware of what is expected of them in relation to the policies and procedures of the school. This will include dress code, attendance, academic requirements, discipline, and transportation regulations. Students will work together in pairs. A student with a higher reading ability will team up with a student with a lower reading ability to get a better understanding of the school's program policies and procedures. Submit written report on rules and regulations. <p>Assessment:</p> <ul style="list-style-type: none"> • Assess student orientation, policy, and procedure knowledge through instructor observations and written unit test. File completed test to document student mastery of the school and program policies and procedures. • The report will be evaluated for clarity and content using the Written Report Evaluation in Appendix E.
<p>2. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.</p> <p>a. Demonstrate effective teambuilding and leadership skills.</p> <p>b. Practice appropriate work ethics.</p>	<p>Teaching:</p> <ul style="list-style-type: none"> • Discuss the role of a team member and leader. Assign the students roles within a team and have them role play a situation in which there is a conflict which must be resolved. Utilize the lessons from SkillsUSA or other resources to provide additional training. • Discuss appropriate work ethics standards. Have the students list what they believe to be the most common problems in the small engine repair profession. <p>Assessment:</p> <ul style="list-style-type: none"> • Assess the role play using the Role Play or Skit Rubric in Appendix E.

<p>3. Review general safety rules for working in a shop/lab and industry.</p> <ol style="list-style-type: none"> Describe how to avoid on-site accidents. Explain the relationship between housekeeping and safety. Explain the importance of following all safety rules and company safety policies. Explain the importance of reporting all on-the-job injuries, accidents, and near misses. Explain the need for evacuation policies and the importance of following them. Explain the employer's substances abuse policy and how it relates to safety. Explain the safety procedures when working near pressurized or high temperature. 	<p>Teaching:</p> <ul style="list-style-type: none"> Identify, discuss, and demonstrate terms, rules, and procedures related to shop/lab and industry safety. Required written tests will follow each section of guidelines for safety rules and procedures. Provide the students with a list of terms and have them define the terms. Pair the students to quiz each other on the definitions in preparation for a written exam. Use the guidelines provided for personal safety (i.e. clothing, jewelry, hair, eyes, and ears). Divide the students into pairs and assign each pair one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the guideline. Have an industry speaker present to the class the necessity of safety in the work environment. The students will write a summary of the presentation. NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR. <p>Assessment:</p> <ul style="list-style-type: none"> Student participation will be monitored by the instructor and the written exam will be graded. The student must achieve 100 % accuracy. The "do's and don'ts" exercise will be critiqued with a peer review. The summary of the speaker's presentation will be critiqued using the Written Report Evaluation in Appendix E.
<p>4. Review procedures for working with and disposing of hazardous materials according to OSHA regulations.</p> <ol style="list-style-type: none"> Define terms, categories, and symbols associated with hazardous materials. Describe and identify methods and procedures for storing materials and reducing hazardous waste. Identify and describe the informational sections found on a Material Safety Data Sheet (MSDS). 	<p>Teaching:</p> <ul style="list-style-type: none"> Provide students with a list of terms associated with hazardous materials including carcinogens, batteries, acids, flammables, and radioactive materials. Have the students define the terms through the use of printed material and Internet searches. Provide students with a list of the Classes (Class 1-9) and signal words or symbols related to hazardous materials including

<p>d. Describe general first aid procedures in case of an accident involving hazardous materials.</p> <p>e. Identify safety equipment to be used with hazardous materials.</p> <p>f. Describe steps to follow in handling spills and waste disposal.</p>	<p>Class 2 Gases, Class 3 Flammable Liquids, and Class 8 Corrosives. Divide the students into pairs or groups; assign each group a class. The group will research information to include first aid procedures, safety equipment, MSDS requirements, and storing materials. The pairs or groups will present the information to the rest of the class. Using the information from their research, the pairs or groups will develop scenarios of hazards and accidents. The pairs or groups will swap scenarios, develop a prevention plan and a treatment program, and present the plan to the rest of the class.</p> <p>Assessment:</p> <ul style="list-style-type: none"> • Assessment will be teacher observation, student participation, written test, and the Presentation Evaluation in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.

- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.

Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.

Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.

Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.

Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.

Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.

Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jacksmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 2: Charging Systems

(15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
1. Explain the components of small engine charging systems. <ol style="list-style-type: none"> a. Identify components of the charging system and state the function(s) of each. 	Teaching: <ul style="list-style-type: none"> • Discuss and display components of the charging system and state the function(s) of each, including generator or alternator, regulator, and ammeter. Have the student match the name and function of the visual display. Assessment: <ul style="list-style-type: none"> • Assess the matching exercise for accuracy.
2. Service a small engine charging system. <ol style="list-style-type: none"> a. Remove, check, and replace an alternator according to manufacturer's specifications. 	Teaching: <ul style="list-style-type: none"> • Demonstrate removing, checking, and replacing an alternator. Have the students perform an exercise to remove, check, and replace an alternator according to manufacturer's specifications. Assessment: <ul style="list-style-type: none"> • Assess student performance using the Performance Rubric in Appendix E.

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
 OPE3 Electrical
 OPE4 Compact Diesel
 OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
 A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
 E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
 E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
 E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.

- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.

- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>
- Grounds maintenance*. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>
- Jack's small engines*. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>
- Kawasaki engines*. Retrieved October 18, 2005, from <http://www.kawpowr.com/>
- Kohler engines*. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>
- Landscape construction magazine*. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>
- Landscape management*. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>
- Lawn and landscape magazine*. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from
<http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 3: Governor Systems

(15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain governor systems used in small engines.</p> <ol style="list-style-type: none"> Describe purposes of the governor system. Identify components of an air vane governor system and state the purpose of each. Identify components of a mechanical governor system and state the purpose of each. 	<p>Teaching:</p> <ul style="list-style-type: none"> Have students read information from text regarding purposes of the governor system including maintenance of selected speed, prevention of over-speeding that may cause engine damage, and limiting high and low speeds. The students will be divided into groups to discuss the material read. A summary of the group discussion will be presented to the class. Display the components of an air vane governor system using a working model and discuss the purpose of each. Have the students match the components and the purpose from a visual display. Display components of a mechanical governor system using a working model. Have the student read and prepare an oral report on the mechanical governor system and its purpose. <p>Assessment:</p> <ul style="list-style-type: none"> Assess the group discussion and summary using teacher observation and the Written Report Evaluation in Appendix E. Assess the matching activity for accuracy. Assess the oral report using the Presentation Evaluation in Appendix E.
<p>2. Inspect, adjust, and repair small engine governor systems.</p> <ol style="list-style-type: none"> Inspect, adjust, and repair an air vane governor according to manufacturer's specifications. Inspect, adjust, and repair a mechanical governor with internal flyweights according to manufacturer's specifications. Service small engine controls according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate how to inspect, adjust, and repair an air vane governor according to manufacturer's specifications. The students will inspect, adjust, and repair an air vane governor. Demonstrate how to inspect, adjust, and repair a mechanical governor with internal flyweights according to manufacturer's specifications. The students will inspect, adjust, and repair a mechanical governor. Demonstrate how to service small engine controls according to manufacturer's specifications. The students will service small engine controls.

	Assessment: <ul style="list-style-type: none"> Assess student work using the Performance Rubric in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

OPE1 2 & 4 Stroke Gasoline Engines

OPE4 Compact Diesel

OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.

- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>.

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 4: Starting Systems

(15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the components of small engine starting systems.</p> <ol style="list-style-type: none"> Describe the types of starting systems. Identify the components and functions of a mechanical starting system. Identify the components and functions of a DC starting system. 	<p>Teaching:</p> <ul style="list-style-type: none"> Describe the types of starting systems using visual representation and text information. Divide the students into pairs or groups and have them discuss the advantages and disadvantages of each system. Each pair or group will present a summary of the discussion to the class. Discuss components of a mechanical starting system. Provide the students with a list of the components and have them determine the function of each component. Provide a display of the major components of a DC starting system. Using an activity sheet and available resources, the students will identify these components and describe the function of each component. <p>Assessment:</p> <ul style="list-style-type: none"> Assess student summaries using the Written Report Evaluation in Appendix E. Assess student ability to accurately identify and determine functions of components.
<p>2. Test/service small engine starting systems.</p> <ol style="list-style-type: none"> Remove, test/service, and replace a DC starter according to manufacturer's specifications. Replace a starter rewind spring according to manufacturer's specifications. Service the vertical pull starter according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate procedures to remove, test/service, and replace a DC starter according to manufacturer's specifications. The student will perform removal, test/service, and replace a DC starter. Demonstrate procedures to replace a starter rewind spring according to manufacturer's specifications. The student will replace a starter rewind spring. Demonstrate procedures to service the vertical pull starter according to manufacturer's specifications. The student will service the vertical pull starter. <p>Assessment:</p> <ul style="list-style-type: none"> Assess student performance of activities using the Performance Rubric in Appendix E.

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.

- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>

- Grounds maintenance.* Retrieved October 12, 2005, from <http://www.grounds-mag.com/>
- Jack's small engines.* Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>
- Kawasaki engines.* Retrieved October 18, 2005, from <http://www.kawpowr.com/>
- Kohler engines.* Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>
- Landscape construction magazine.* Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>
- Landscape management.* Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>
- Lawn and landscape magazine.* Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>
- Society of automotive engineers.* Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>
- Turf magazine.* Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 5: Exhaust Systems

(15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the functions of small engine exhaust systems.</p> <ol style="list-style-type: none"> a. Define terms associated with exhaust systems. b. Describe results that can occur from running a damaged or worn exhaust system. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Have students read related exhaust system text information and provide students with a list of terms. Have students define terms. Divide students into pairs and have them practice quizzing each other on the terms. Each pair will develop a quiz and then swap with another pair to be tested. • Provide the students with examples of damaged or worn exhaust systems. Explain how those can affect an engine and the environment. Have the students research criteria to meet emissions certification. Have students develop a handout containing resources, criteria, contact information, etc. Handouts will be distributed to the rest of the class. <p>Assessment:</p> <ul style="list-style-type: none"> • Monitor student participation in term activity. • Assess the handout using the Written Report Evaluation in Appendix E.
<p>2. Service the exhaust system on two- and four-stroke cycle engines.</p> <ol style="list-style-type: none"> a. Remove carbon deposits from exhaust ports and muffler of a two-stroke cycle engine according to manufacturer's specifications. b. Replace a muffler on a small engine according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Demonstrate procedures to remove carbon deposits from exhaust ports and muffler of a two-stroke cycle engine according to manufacturer's specifications. Students will remove carbon deposits from exhaust ports and muffler. • Demonstrate procedures to replace a muffler on a small engine according to manufacturer's specifications. Students will replace a muffle on a small engine. <p>Assessment:</p> <ul style="list-style-type: none"> • Assess student performance using the Performance Rubric in Appendix E.

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE4 Compact Diesel

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.

- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>

- Grounds maintenance.* Retrieved October 12, 2005, from <http://www.grounds-mag.com/>
- Jack's small engines.* Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>
- Kawasaki engines.* Retrieved October 18, 2005, from <http://www.kawpowr.com/>
- Kohler engines.* Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>
- Landscape construction magazine.* Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>
- Landscape management.* Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>
- Lawn and landscape magazine.* Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>
- Society of automotive engineers.* Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>
- Turf magazine.* Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 6: Shop Management

(15 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Apply principles of customer relations in the small engine repair shop.</p> <ol style="list-style-type: none"> Communicate with customer and/or supervisor to determine service requested. Complete customer work order form. 	<p>Teaching:</p> <ul style="list-style-type: none"> Discuss how to communicate with customer and/or supervisor to determine service requested including listening, interpreting, and applying oral and written communications. Demonstrate how to complete customer work order form including using the manufacturer's parts manual and the standard work order form to request parts for the engine being repaired and make a formal record to provide accountability of parts used. Pair the students and provide a scenario of a customer and technician discussing service needed and a work order form. Have the student role play the scenario and complete the work order form. <p>Assessment:</p> <ul style="list-style-type: none"> Monitor student participation, and assess the role play using the Role Play or Skit Rubric in Appendix E.
<p>2. Apply procedures of shop management in the small engine repair shop.</p> <ol style="list-style-type: none"> Utilize parts identification media. Maintain work records to account for parts and labor. Conduct product liability procedures. Prepare customer bill/receipt so that the completed product is legible, is free of mathematical error, and accurately reflects the transaction. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate how to utilize parts identification media including parts manuals, microfiche, and computerized parts identification systems. Provide the students with a practice worksheet to be followed by a written test. Assist students to maintain work records to account for parts and labor including verification of completed standard work order forms to indicate the major repairs made, parts used, and time taken. Provide students with scenarios to complete work records and have them put them in a portfolio. Discuss product liability guidelines and ANSI Standards. Provide the students with a replacement part. They are to locate the liability guidelines, show the teacher where they are, read them, and summarize the guidelines.

	<ul style="list-style-type: none"> Demonstrate how to prepare customer bill/receipt so that the completed product is legible, is free of mathematical error, and accurately reflects the transaction including service performed, parts repaired or replaced, labor, sales tax, and total cost. Provide the student with a billing scenario and have them correctly complete the bill/receipt form. <p>Assessment:</p> <ul style="list-style-type: none"> Assess parts identification worksheet and test, work records scenarios, liability guidelines summary, and billing scenario for accuracy and completion.
--	--

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- A5 Utilize various formulas in problem-solving situations.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.

- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Cheesebro, T., O'Connor, L., & Rios, F. (2006). *Oral workplace communication: Job talk*. Upper Saddle River, NJ: Prentice Hall.
- Harris, E. (2002). *Customer service: A practical approach*. Upper Saddle River, NJ: Prentice Hall.
- Invo Max [Computer Software]. Available from InvoMax Web site, <http://www.invomax.com/>

Sformo, T., Sformo, L., & Moore, G. (2005). *Practical problems in mathematics for automotive technicians*. Albany, NY: Delmar.

Timm, P. R. (2005). *Customer service: Career success through customer satisfaction*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 7: Employability Skills

(22.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Describe employment opportunities and responsibilities.</p> <p>a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements.</p> <p>b. Describe basic employee responsibilities.</p>	<p>Teaching:</p> <ul style="list-style-type: none"> • Have students define trade terms related to basic employability skills. Lessons involving writing and math skills will be integrated with the appropriate department. • Students will interview individuals in the automotive industry. Students will be provided questions by the instructor. The student will write a report on the interview and present the report to the class. • Students will research the phone book (yellow pages), Internet, and newspapers for employment opportunities. • Students will participate in a mock interview. Industry representatives will interview students. • Invite a guest speaker to discuss industry related information. • Students will use career software, such as Choices, to measure their aptitudes and abilities for particular careers. • Students will use the Internet to research a list of careers for which they will be qualified upon program completion and write a brief summary. • Students will use available resources (college catalogs and college Web Sites) to research information about postsecondary educational opportunities and write a brief summary. • Students will select a career in the field and outline educational and skill requirements, expected job growth, and entry-level salaries and write a brief summary. <p>Assessment:</p> <ul style="list-style-type: none"> • Assess student ability to define terms accurately. • The presentation on the industry interview will be evaluated using the Presentation Evaluation in Appendix E. • Monitor students for participation in

	<p>activities.</p> <ul style="list-style-type: none"> • Review career software printout to assess student aptitudes and abilities. • Evaluate summaries using the Written Report Evaluation in Appendix E.
<p>2. Prepare for employment.</p> <ol style="list-style-type: none"> a. Prepare a resume containing essential information. b. Complete a job application form using correct grammar, spelling, and punctuation. c. Explain five procedures for job interviews using correct job etiquette. d. Utilize correct interview procedures. 	<p>Teaching:</p> <ul style="list-style-type: none"> • Discuss ways to prepare a resume containing essential information including personal information, education, and employment experience using correct grammar, spelling, and punctuation. Provide students with sample resumes and have them prepare their own resume. • Discuss ways to complete a job application form using correct grammar, spelling, and punctuation. Provide the students with sample applications and have them complete an application. • Discuss the importance of the job interview, and describe appropriate and inappropriate interview techniques. Describe job interview etiquette including behavior, appearance, attire, questioning technique, response to questions, correct English, and knowledge of company products or services. Divide students into teams of two and have them complete a mock interview with one team member as the interviewer and the other as the interviewee, or ask Advisory Committee members to interview students. <p>Assessment:</p> <ul style="list-style-type: none"> • Assess resume using the Resume Rubric in Appendix E. • Assess completed application for accuracy and neatness. • Monitor participation in mock interview.

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel

Secondary Small Engine Repair

OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Fry, R. (2000). *101 answers to the toughest interview questions*. Albany, NY: Delmar.
- Fry, R. (2001). *101 great resumes*. Albany, NY: Delmar.
- Fry, R. (2002). *Your first resume*. Albany, NY: Delmar.
- Fry, R. (2003). *101 smart questions to ask on your interview*. Albany, NY: Delmar.
- Gould, M. (2002). *Developing literacy & workplace skills*. Bloomington, IN: National Education Service.
- Krantman, S. (2001). *Resume writers workbook*. Albany, NY: Delmar.
- Pigford, L. (2001). *The successful interview and beyond*. Albany, NY: Delmar.

Small Engine Repair II

Unit 8: Overhaul of Four-Stroke Cycle Engine

(30 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Describe the parts of a four-stroke cycle engine.</p> <ol style="list-style-type: none"> Define terms associated with engine parts and overhaul. Explain causes of engine problems. Identify parts of a piston and connecting rod assembly. Identify parts of the crankshaft assembly. Identify parts of a valve train. 	<p>Teaching:</p> <ul style="list-style-type: none"> Provide students with a list of terms and definitions relating to parts and overhaul. Discuss these terms including piston and connecting rod assembly, valve train, crankshaft assembly, and multi-piece crankshaft. Divide students into pairs to practice quiz each other prior to written test. Students will read information from text and other resources and discuss causes of engine problems including allowing dirt to get into engine, overloading engine, running the engine at excessive rpm, and inadequate lubrication. Discuss causes of problems. Display parts of a piston and connecting rod assembly including piston head, skirt, pin hole, oil ring groove, connecting rod, retaining ring, piston pin, land, ring side clearance, and rod bearing cap. Using a visual presentation, have the students match the parts with their names. Display parts of the crankshaft assembly including main bearing journals, crankpin, and counterweights. Using a visual presentation, have the students match the parts with their names. Display parts of a valve train including margin, seat, stem, face, retainer, cam, head, valve guide, valve spring, adjusting nut, and tappet guide. Using a visual presentation, have the students match the parts with their names. <p>Assessment:</p> <ul style="list-style-type: none"> Monitor students for participation in the practice quizzing on terms and discussion of causes of engine problems. Assess the matching parts and names activity for accuracy.

<p>2. Inspect and overhaul the four-stroke cycle engine.</p> <ol style="list-style-type: none"> Disassemble a four-stroke cycle engine according to manufacturer's specifications. Inspect and overhaul a cylinder according to manufacturer's specifications. Inspect and overhaul the piston, rings, and connecting rod according to manufacturer's specifications. Inspect and overhaul a valve assembly according to manufacturer's specifications. Reassemble a four-stroke cycle engine according to manufacturer's specifications. Replace a short block assembly on a four-stroke cycle engine according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate procedures to disassemble a four-stroke cycle engine according to manufacturer's specifications. Students will disassemble a four-stroke cycle engine. Demonstrate procedures to inspect and overhaul a cylinder according to manufacturer's specifications. Students will inspect and overhaul a cylinder. Demonstrate procedures to inspect and overhaul the piston, rings, and connecting rod according to manufacturer's specifications. Students will inspect and overhaul the piston, rings, and connecting rod. Demonstrate procedures to inspect and overhaul a valve assembly according to manufacturer's specifications. Students will inspect and overhaul a valve assembly. Demonstrate procedures to reassemble a four-stroke cycle engine according to manufacturer's specifications. Students will reassemble a four-stroke cycle engine. Demonstrate procedures to replace a short block assembly on a four-stroke cycle engine according to manufacturer's specifications. Students will replace a short block assembly. <p>Assessment:</p> <ul style="list-style-type: none"> Monitor student participation, and assess performance using the Performance Rubric in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts

- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>
- Grounds maintenance*. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>
- Jack's small engines*. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>
- Kawasaki engines*. Retrieved October 18, 2005, from <http://www.kawpowr.com/>
- Kohler engines*. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 9: Overhaul of Two-Stroke Cycle Engine

(30 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Describe the parts of a two-stroke cycle engine.</p> <ol style="list-style-type: none"> Define terms associated with engine parts and overhaul. Explain causes of two-stroke cycle engine problems. Identify parts of the piston and connecting rod assembly. Identify parts of the two-cycle crankshaft assembly. 	<p>Teaching:</p> <ul style="list-style-type: none"> Provide students with a list of terms and definitions relating to parts and overhaul. Discuss these terms. Divide students into pairs to practice quiz each other prior to written test. Students will read information from text and other resources and discuss causes of engine problems. Discuss causes of engine problems. Display parts of a piston and connecting rod assembly. Using a visual presentation, have the students match the parts with their names. Display parts of the crankshaft assembly. Using a visual presentation, have the students match the parts with their names. <p>Assessment:</p> <ul style="list-style-type: none"> Monitor students for participation in the practice quizzing on terms and discussion of causes of engine problems. Assess the matching parts and names activity for accuracy.
<p>2. Inspect and overhaul the two-stroke cycle engine.</p> <ol style="list-style-type: none"> Disassemble, inspect, and overhaul a two-stroke cycle engine according to manufacturer's specifications. Reassemble a two-stroke cycle engine according to manufacturer's specifications. Replace a short block assembly on a two-stroke cycle engine according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate procedures to disassemble, inspect, and overhaul a two-stroke cycle engine according to manufacturer's specifications. Students will disassemble, inspect, and overhaul a two-stroke cycle engine. Demonstrate procedures to reassemble a two-stroke cycle engine according to manufacturer's specifications. Students will reassemble a two-stroke cycle engine. Demonstrate procedures to replace a short block assembly on a two-stroke cycle engine according to manufacturer's specifications. Students will replace a short block assembly on a two-stroke cycle engine.

	Assessment: <ul style="list-style-type: none"> Monitor student participation, and assess performance using the Performance Rubric in Appendix E.
--	--

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.

- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.

Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

Briggs and Stratton. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>

Compact equipment. Retrieved October 21, 2005, from <http://www.compactequip.com/>

Grounds maintenance. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>

Jack's small engines. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>

Kawasaki engines. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Small Engine Repair II
Unit 10: Troubleshooting

(37.5 hours)

Competencies and Suggested Objectives	Suggested Strategies for Competencies
<p>1. Explain the requirements for small engine operation and the basic steps to troubleshooting.</p> <ol style="list-style-type: none"> Review requirements for an engine to operate. Describe basic troubleshooting procedures and the order in which they need to be followed. 	<p>Teaching:</p> <ul style="list-style-type: none"> Have the students discuss requirements for an engine to operate including compression, ignition, and combustion. Describe basic troubleshooting procedures and the order in which they need to be followed including knowing the engine, asking the operator, inspecting the engine, operating the engine if possible, and formulating a conclusion. Provide the students with a handout with various engine problems. Have them refer to a troubleshooting chart and provide a possible cause and remedy. <p>Assessment:</p> <ul style="list-style-type: none"> Evaluate the handout using the Written Report Evaluation in Appendix E.
<p>2. Perform troubleshooting procedures on small engine components.</p> <ol style="list-style-type: none"> Troubleshoot the fuel system according to manufacturer's specifications. Troubleshoot the ignition system according to manufacturer's specifications. Troubleshoot engine compression according to manufacturer's specifications. 	<p>Teaching:</p> <ul style="list-style-type: none"> Demonstrate procedures to troubleshoot the fuel system according to manufacturer's specifications. Students will troubleshoot the fuel system. Demonstrate procedures to troubleshoot the ignition system according to manufacturer's specifications. Students will troubleshoot the ignition system. Demonstrate procedures to troubleshoot engine compression according to manufacturer's specifications. Students will troubleshoot engine compression. <p>Assessment:</p> <ul style="list-style-type: none"> Assessment will be the Performance Rubric in Appendix E.

STANDARDS

Equipment & Engine Training Council Standards

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel

Secondary Small Engine Repair

OPE5 Generators

Academic Standards

- A1 Recognize, classify, and use real numbers and their properties.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- E10 Use language and critical thinking strategies to serve as tools for learning.

Workplace Skills for the 21st Century

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

National Educational Technology Standards for Students

- T1 Basic operations and concepts
- T2 Social, ethical, and human issues
- T3 Technology productivity tools
- T4 Technology communications tools
- T5 Technology research tools
- T6 Technology problem-solving and decision-making tools

SUGGESTED REFERENCES

Books

- Chilton Automotive Books. (1994). *Small engine repair—Up to 20 HP*. W. G. Nichols.
- Hilley, R. (1996). *Power product equipment technician: Engine systems and service; Section A: Engine systems*. Stillwater, OK: Multistate Academic and Vocational Curriculum Consortium.
- Johns, B. A., Edmundson, D., & Schaff, R. (1999). *Motorcycles: Fundamentals, service, repair*. Tinley Park, IL: Goodheart-Willcox.
- Osaji, M. (1994). *Mississippi works: Four-stroke and two-stroke cycle engines—Industrial maintenance mechanics*. Mississippi State, MS: Research and Curriculum Unit.
- Radcliff, R. B., & Roark, D. (2004). *Small engines*. Homewood, IL: American Technical Publishers.
- Roth, A. (2004). *Small gas engines*. Tinley Park, IL: Goodheart-Willcox.
- Schuster, W. (1999). *Small engine technology*. Albany, NY: Delmar.
- Stagner, E. (1998). *Small engines fundamentals and service*. Upper Saddle River, NJ: Prentice Hall.

Web Sites

- Briggs and Stratton*. Retrieved October 18, 2005, from <http://www.briggsandstratton.com/>
- Compact equipment*. Retrieved October 21, 2005, from <http://www.compactequip.com/>
- Grounds maintenance*. Retrieved October 12, 2005, from <http://www.grounds-mag.com/>
- Jack's small engines*. Retrieved October 27, 2005, from <http://www.jackssmallengines.com/>
- Kawasaki engines*. Retrieved October 18, 2005, from <http://www.kawpowr.com/>

Kohler engines. Retrieved October 12, 2005, from <http://www.kohlerengines.com/index.jsp/>

Landscape construction magazine. Retrieved October 21, 2005, from <http://www.lcmmagazine.com/>

Landscape management. Retrieved October 12, 2005, from <http://www.landscapemanagement.net/landscape/>

Lawn and landscape magazine. Retrieved October 21, 2005, from <http://www.lawnandlandscape.com/>

Society of automotive engineers. Retrieved October 27, 2005, from <http://www.sae.org/servlets/index>

Turf magazine. Retrieved October 21, 2005, from <http://www.turfmagazine.com/>

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Air compressor (1)
2. Computer with Internet access (2)
3. Pressure washer (1)

NON-CAPITALIZED ITEMS

1. Brush, wire (5)
2. Cables, battery jumper (1)
3. Caliper (1)
4. Chisel, cold (1)
5. Cleaner, ring groove (5)
6. Compressor, piston ring (5)
7. Compressor, valve spring (5)
8. Drill, portable (2)
9. Engine, small (4-cycle, 2-5 hp with horizontal shaft) (5)
10. Engine, small (4-cycle, 2-5 hp with vertical shaft, overhead valve) (2)
11. Expander, piston ring (2)
12. File set, assorted (5)
13. File, metric thread (1)
14. File, standard thread (1)
15. Flashlight with gooseneck adapter (2)
16. Gage, breaker plunger (1)
17. Gage, compression (5)
18. Gage, cylinder dial (1)
19. Gage, feeler (5)
20. Gage, plug (for a given engine) (5)
21. Glaze breaker (1)
22. Grease gun (hand operated, cartridge) (1)
23. Grinder, portable with wire brush (1)
24. Hacksaw (3)
25. Hammer, ball peen (5)
26. Hammer, brass (5)
27. Holder, flywheel (5)
28. Hone, cylinder (midget) (1)
29. Impact tool, set (1)
30. Key, metric hex (1)
31. Lamp, 12 V test (1)
32. Light, timing (1)
33. Light, trouble (2)
34. Magnet, with handle (1)
35. Micrometer, assorted sizes (1@)
36. Multimeter, digital, VOM (3)

37. Nut driver, set (1)
38. Nut cracker (1)
39. Pilot set (for a given engine) (1)
40. Pliers, assorted (5)
41. Pliers, retaining ring (convertible type) (2)
42. Pliers, vise grip (5)
43. Press, arbor (1)
44. Printer, laser (1)
45. Puller set, bearing (1)
46. Puller, flywheel (5)
47. Punch set, metal (assorted) (1)
48. Reamer set (for a given engine) (5)
49. Reamer, ridge (1)
50. Rule, steel (2)
51. Scraper, gasket (5)
52. Screw extractor set (1)
53. Screwdriver set (assorted, flat blade) (5)
54. Screwdriver set (assorted, Phillips) (5)
55. Screwdriver set, carburetor jet (small) (2 per set) (5)
56. Small engine portable work lift (1)
57. Soldering iron (1)
58. Sprocket tool (1)
59. Stand, small engine (5)
60. Starter, rewind crank (1)
61. Stud remover (1)
62. Tachometer, vibrator type (5)
63. Tap and die set, SAE (1)
64. Tap and die set, metric (1)
65. Terminal lifters, battery (1)
66. Terminal cleaner, battery (2)
67. Tester, c.d. ignition (1)
68. Tester, diode (1)
69. Tester, ignition (M-80) (1)
70. Tester, spark (5)
71. Tester, coil and condenser (5)
72. Tool, tubing (1)
73. Torx set (5)
74. Valve grinding machine (wet valve for small engine) (1)
75. Valve seat repair set (for a given engine) (1)
76. Vise, swivel base (5)
77. Washer, parts (1)
78. Welder, oxyacetylene (1)
79. Wrench, air impact (1/2") (1)
80. Wrench, adjustable (5)
81. Wrench, clutch (5)
82. Wrench, ignition (5)

83. Wrench set, Allen (5)
84. Wrench set, combination (5)
85. Wrench set, socket, 1/4" drive (5)
86. Wrench set, socket, 3/8" drive (5)
87. Wrench set, socket, 1/2" drive (2)
88. Wrench, sparkplug (5)
89. Wrench, torque (foot/lbs.) (5)
90. Wrench, torque (inch/lbs.) (5)

RECOMMENDED INSTRUCTIONAL AIDS

Teachers should have access to:

1. Calculator (1)
2. Cart, AV (for overhead projector) (1)
3. Cart, AV (For TV-VCR) (1)
4. Projector, overhead (1)
5. Software for parts identification and cost estimation in Small Engine Repair
6. TV-VCR/DVD (1)
7. Data projector (1)
8. Teacher computer with printer

Student Competency Profile for Small Engine Repair I

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. Noted in parentheses beside each unit is the cluster competency from the MS-CPAS. This form may be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

As an alternative to the use of this form, you may note competency achievement by attaching a report showing comparable results for each student. Please indicate that you are using this alternative report by checking here. _____

Unit 1: Safety and Orientation

- _____ 1. Describe local program and vocational/career technical center policies and procedures.
- _____ 2. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
- _____ 3. Describe general safety rules for working in a shop/lab and industry.
- _____ 4. Explain procedures for working with and disposing of hazardous materials according to OSHA regulations.

Unit 2: Tools and Equipment

- _____ 1. Explain the safe use and maintenance of tools and equipment.
- _____ 2. Identify common fasteners and describe their use.
- _____ 3. Apply measurement procedures used in small engine repair.

Unit 3: Engine Identification and Inspection

- _____ 1. Identify types of small engines.

Unit 4: Basic Engine Principles and Design

- _____ 1. Explain the principles of operation of an internal combustion engine.
- _____ 2. Analyze engine horsepower rating.
- _____ 3. Explain the principles of four-stroke cycle engine operation.
- _____ 4. Explain the principles of two-stroke cycle engine operation.
- _____ 5. Describe the basic operation principles of a diesel engine.

Unit 5: Basic Electricity

- _____ 1. Explain the principles of basic electricity.
- _____ 2. Describe instruments and perform measurements of electricity.

Unit 6: Ignition Systems

- _____1. Explain the components of a small engine ignition system.
- _____2. Service and test small engine ignition systems.

Unit 7: Lubrication Systems

- _____1. Explain the principles of lubrication and engine oils.
- _____2. Perform lubrication services on small engines.
- _____3. Apply procedures for preparing a small engine for storage.

Unit 8: Cooling Systems

- _____1. Service an air-cooled small engine system.
- _____2. Service a liquid-cooled small engine system.

Unit 9: Fuel Systems (Carburetor-Type)

- _____1. Identify fuel and fuel systems used in small engines.
- _____2. Remove, service, replace, and adjust an air cleaner, oil bath cleaner, float-type carburetor, and diaphragm-type carburetor.

Student Competency Profile for Small Engine Repair II

Student: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. Noted in parentheses beside each unit is the cluster competency from the MS-CPAS. This form may be duplicated for each student and serve as a cumulative record of competencies achieved in the course.

As an alternative to the use of this form, you may note competency achievement by attaching a report showing comparable results for each student. Please indicate that you are using this alternative report by checking here. _____

Unit 1: Safety and Orientation (Review and Reinforcement)

- _____ 1. Describe local program and vocational/career technical center policies and procedures.
- _____ 2. Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA.
- _____ 3. Review general safety rules for working in a shop/lab and industry.
- _____ 4. Review procedures for working with and disposing of hazardous materials according to OSHA regulations.

Unit 2: Charging Systems

- _____ 1. Explain the components of small engine charging systems.
- _____ 2. Service a small engine charging system.

Unit 3: Governor Systems

- _____ 1. Explain governor systems used in small engines.
- _____ 2. Inspect, adjust, and repair small engine governor systems.

Unit 4: Starting Systems

- _____ 1. Explain the components of small engine starting systems.
- _____ 2. Test/service small engine starting systems.

Unit 5: Exhaust Systems

- _____ 1. Explain the functions of small engine exhaust systems.
- _____ 2. Service the exhaust system on two- and four-stroke cycle engines.

Unit 6: Shop Management

- _____ 1. Apply principles of customer relations in the small engine repair shop.

____2. Apply procedures of shop management in the small engine repair shop.

Unit 7: Employability Skills

____1. Describe employment opportunities and responsibilities.

Unit 8: Overhaul of Four-Stroke Cycle Engine

____1. Describe the parts of a four-stroke cycle engine.

____2. Inspect and overhaul the four-stroke cycle engine.

Unit 9: Overhaul of Two-Stroke Cycle Engine

____1. Describe the parts of a two-stroke cycle engine.

____2. Inspect and overhaul the two-stroke cycle engine.

Unit 10: Troubleshooting

____1. Explain the requirements for small engine operation and the basic steps to troubleshooting.

____2. Perform troubleshooting procedures on small engine components.

Appendix A: Equipment & Engine Training Council Standards for Small Engine Repair¹

- OPE1 2 & 4 Stroke Gasoline Engines
- OPE2 Drivelines/Hydraulics/Hydrostatics
- OPE3 Electrical
- OPE4 Compact Diesel
- OPE5 Generators

¹ Equipment & Engine Training Council. (2002). *Outdoor power equipment standards for accreditation*. Hartland, WI: Author.

Appendix B: Academic Standards

Algebra I²

Competencies and Suggested Objective(s)

- A1 Recognize, classify, and use real numbers and their properties.
- Describe the real number system using a diagram to show the relationships of component sets of numbers that compose the set of real numbers.
 - Model properties and equivalence relationships of real numbers.
 - Demonstrate and apply properties of real numbers to algebraic expressions.
 - Perform basic operations on square roots excluding rationalizing denominators.
- A2 Recognize, create, extend, and apply patterns, relations, and functions and their applications.
- Analyze relationships between two variables, identify domain and range, and determine whether a relation is a function.
 - Explain and illustrate how change in one variable may result in a change in another variable.
 - Determine the rule that describes a pattern and determine the pattern given the rule.
 - Apply patterns to graphs and use appropriate technology.
- A3 Simplify algebraic expressions, solve and graph equations, inequalities and systems in one and two variables.
- Solve, check, and graph linear equations and inequalities in one variable, including rational coefficients.
 - Graph and check linear equations and inequalities in two variables.
 - Solve and graph absolute value equations and inequalities in one variable.
 - Use algebraic and graphical methods to solve systems of linear equations and inequalities.
 - Translate problem-solving situations into algebraic sentences and determine solutions.
- A4 Explore and communicate the characteristics and operations of polynomials.
- Classify polynomials and determine the degree.
 - Add, subtract, multiply, and divide polynomial expressions.
 - Factor polynomials using algebraic methods and geometric models.
 - Investigate and apply real-number solutions to quadratic equations algebraically and graphically.
 - Use convincing arguments to justify unfactorable polynomials.
 - Apply polynomial operations to problems involving perimeter and area.
- A5 Utilize various formulas in problem-solving situations.
- Evaluate and apply formulas (e.g., circumference, perimeter, area, volume, Pythagorean Theorem, interest, distance, rate, and time).
 - Reinforce formulas experimentally to verify solutions.

² *Mississippi mathematics framework—Algebra I*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/mathematics/ma_algebra_i.html

- c. Given a literal equation, solve for any variable of degree one.
 - d. Using the appropriate formula, determine the length, midpoint, and slope of a segment in a coordinate plane.
 - e. Use formulas (e.g., point-slope and slope-intercept) to write equations of lines.
- A6 Communicate using the language of algebra.
- a. Recognize and demonstrate the appropriate use of terms, symbols, and notations.
 - b. Distinguish between linear and non-linear equations.
 - c. Translate between verbal expressions and algebraic expressions.
 - d. Apply the operations of addition, subtraction, and scalar multiplication to matrices.
 - e. Use scientific notation to solve problems.
 - f. Use appropriate algebraic language to justify solutions and processes used in solving problems.
- A7 Interpret and apply slope as a rate of change.
- a. Define slope as a rate of change using algebraic and geometric representations.
 - b. Interpret and apply slope as a rate of change in problem-solving situations.
 - c. Use ratio and proportion to solve problems including direct variation ($y=kx$).
 - d. Apply the concept of slope to parallel and perpendicular lines.
- A8 Analyze data and apply concepts of probability.
- a. Collect, organize, graph, and interpret data sets, draw conclusions, and make predictions from the analysis of data.
 - b. Define event and sample spaces and apply to simple probability problems.
 - c. Use counting techniques, permutations, and combinations to solve probability problems.

Biology I³

Competencies and Suggested Objective(s)

- B1 Utilize critical thinking and scientific problem solving in designing and performing biological research and experimentation.
- a. Demonstrate the proper use and care for scientific equipment used in biology.
 - b. Observe and practice safe procedures in the classroom and laboratory.
 - c. Apply the components of scientific processes and methods in the classroom and laboratory investigations.
 - d. Communicate results of scientific investigations in oral, written, and graphic form.
- B2 Investigate the biochemical basis of life.
- a. Identify the characteristics of living things.
 - b. Describe and differentiate between covalent and ionic bonds using examples of each.
 - c. Describe the unique bonding and characteristics of water that makes it an essential component of living systems.

³ *Mississippi science framework—Biology I*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/science/sci_biology_I.html

- d. Classify solutions using the pH scale and relate the importance of pH to organism survival.
 - e. Compare the structure, properties and functions of carbohydrates, lipids, proteins and nucleic acids in living organisms.
 - f. Explain how enzymes work and identify factors that can affect enzyme action.
- B3 Investigate cell structures, functions, and methods of reproduction.
- a. Differentiate between prokaryotic and eukaryotic cells.
 - b. Distinguish between plant and animal (eukaryotic) cell structures.
 - c. Identify and describe the structure and basic functions of the major eukaryotic organelles.
 - d. Describe the way in which cells are organized in multicellular organisms.
 - e. Relate cell membrane structure to its function in passive and active transport.
 - f. Describe the main events in the cell cycle and cell mitosis including differences in plant and animal cell divisions.
 - g. Relate the importance of meiosis to sexual reproduction and the maintenance of chromosome number.
 - h. Identify and distinguish among forms of asexual and sexual reproduction.
- B4 Investigate the transfer of energy from the sun to living systems.
- a. Describe the structure of ATP and its importance in life processes.
 - b. Examine, compare, and contrast the basic processes of photosynthesis and cellular respiration.
 - c. Compare and contrast aerobic and anaerobic respiration.
- B5 Investigate the principles, mechanisms, and methodology of classical and molecular genetics.
- a. Compare and contrast the molecular structures of DNA and RNA as they relate to replication, transcription, and translation.
 - b. Identify and illustrate how changes in DNA cause mutations and evaluate the significance of these changes.
 - c. Analyze the applications of DNA technology (forensics, medicine, agriculture).
 - d. Discuss the significant contributions of well-known scientists to the historical progression of classical and molecular genetics.
 - e. Apply genetic principles to solve simple inheritance problems including monohybrid crosses, sex linkage, multiple alleles, incomplete dominance, and codominance.
 - f. Examine inheritance patterns using current technology (gel electrophoresis, pedigrees, karyotypes).
- B6 Investigate concepts of natural selection as they relate to diversity of life.
- a. Analyze how organisms are classified into a hierarchy of groups and subgroups based on similarities and differences.
 - b. Identify characteristics of kingdoms including monerans, protists, fungi, plants and animals.
 - c. Differentiate among major divisions of the plant and animal kingdoms (vascular/non-vascular; vertebrate/invertebrate).
 - d. Compare the structures and functions of viruses and bacteria relating their impact on other living organisms.

- e. Identify evidence of change in species using fossils, DNA sequences, anatomical and physiological similarities, and embryology.
 - f. Analyze the results of natural selection in speciation, diversity, adaptation, behavior and extinction.
- B7 Investigate the interdependence and interactions that occur within an ecosystem.
- a. Analyze the flow of energy and matter through various cycles including carbon, oxygen, nitrogen and water cycles.
 - b. Interpret interactions among organisms in an ecosystem (producer/consumer/decomposer, predator/prey, symbiotic relationships and competitive relationships).
 - c. Compare variations, tolerances, and adaptations of plants and animals in major biomes.
 - d. Investigate and explain the transfer of energy in an ecosystem including food chains, food webs, and food pyramids.
 - e. Examine long and short-term changes to the environment as a result of natural events and human actions.

English II⁴

Competencies and Suggested Objective(s)

- E1 Produce writing which reflects increasing proficiency through planning, writing, revising, and editing and which is specific to audience and purpose.
- a. Produce individual and/or group compositions and/or projects to persuade, tell a story, describe, create an effect, explain or justify an action or event, inform, entertain, etc.
 - b. Produce writing typically used in the workplace such as social, business, and technical correspondence; explanation of procedures; status reports; research findings; narratives for graphs; justification of decisions, actions, or expenses; etc.
 - c. Write a response, reaction, interpretation, analysis, summary, etc., of literature, other reading matter, or orally presented material.
 - d. Revise to ensure effective introductions, details, wording, topic sentences, and conclusions.
- E2 Communicate ideas for a variety of school and other life situations through listening, speaking, and reading aloud.
- a. Listen to determine the main idea and supporting details, to distinguish fact from opinion, and to determine a speaker's purpose or bias.
 - b. Speak with appropriate intonation, articulation, gestures, and facial expression.
 - c. Speak effectively to explain and justify ideas to peers, to inform, to summarize, to persuade, to entertain, to describe, etc.
- E3 Read, evaluate, and use print, non-print, and technological sources to research issues and problems, to present information, and to complete projects.
- a. Read, view, and listen to distinguish fact from opinions and to recognize persuasive and manipulative techniques.

⁴ *Mississippi language arts framework—English II*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/language_arts/la_10.html

- b. Access both print and non-print sources to produce an I-Search paper, research paper, or project.
 - c. Use computers and audio-visual technology to access and organize information for purposes such as resumes, career search projects, and analytical writings, etc.
 - d. Use reference sources, indices, electronic card catalog, and appropriate research procedures to gather and synthesize information.
- E4 Work individually and as a member of a team to analyze and interpret information, to make decisions, to solve problems, and to reflect, using increasingly complex and abstract thinking.
- a. Interact with peers to examine real world and literary issues and ideas.
 - b. Show growth in critical thinking, leadership skills, consensus building, and self-confidence by assuming a role in a group, negotiating compromise, and reflecting on individual or group work.
- E5 Complete oral and written presentations which exhibit interaction and consensus within a group.
- a. Share, critique, and evaluate works in progress and completed works through a process approach.
 - b. Communicate effectively in a group to present completed projects and/or compositions.
 - c. Edit oral and written presentations to reflect correct grammar, usage, and mechanics.
- E6 Explore cultural contributions to the history of the English language and its literature.
- a. Explore a variety of works from various historical periods, geographical locations, and cultures, recognizing their influence on language and literature.
 - b. Identify instances of dialectal differences which create stereotypes, perceptions, and identities.
 - c. Recognize root words, prefixes, suffixes, and cognates.
 - d. Relate how vocabulary and spelling have changed over time.
- E7 Discover the power and effect of language by reading and listening to selections from various literary genres.
- a. Listen to and read aloud selected works to recognize and respond to the rhythm and power of language to convey a message.
 - b. Read aloud with fluency and expression.
 - c. Analyze the stylistic devices, such as alliteration, assonance, word order, rhyme, onomatopoeia, etc., that make a passage achieve a certain effect.
 - d. Demonstrate how the use of language can confuse or inform, repel or persuade, or inspire or enrage.
 - e. Analyze how grammatical structure or style helps to create a certain effect.
- E8 Read, discuss, analyze, and evaluate literature from various genres and other written material.
- a. Read and explore increasingly complete works, both classic and contemporary, for oral discussion and written analysis.
 - b. Read, discuss, and interpret literature to make connections to life.
 - c. Read from a variety of genres to understand how the literary elements contribute to the overall quality of the work.

- d. Identify qualities in increasingly complex literature that have produced a lasting impact on society.
 - e. Read for enjoyment, appreciation, and comprehension of plot, style, vocabulary, etc.
- E9 Sustain progress toward fluent control of grammar, mechanics, and usage of standard English in the context of writing and speaking.
- a. Infuse the study of grammar and vocabulary into written and oral communication.
 - b. Demonstrate, in the context of their own writing, proficient use of the conventions of standard English, including, but not limited to, the following: complete sentences, subject-verb agreement, plurals, spellings, homophones, possessives, verb forms, punctuation, capitalization, pronouns, pronoun-antecedent agreement, parallel structure, and dangling and misplaced modifiers.
 - c. Give oral presentations to reinforce the use of standard English.
 - d. Employ increasingly proficient editing skills to identify and solve problems in grammar, usage, and structure.
- E10 Use language and critical thinking strategies to serve as tools for learning.
- a. Use language to facilitate continuous learning, to record observations, to clarify thought, to synthesize information, and to analyze and evaluate language.
 - b. Interpret visual material orally and in writing.

U. S. History from 1877⁵

Competencies and Suggested Objective(s)

- H1 Explain how geography, economics, and politics have influenced the historical development of the United States in the global community.
- a. Apply economic concepts and reasoning when evaluating historical and contemporary social developments and issues (e.g., gold standard, free coinage of silver, tariff issue, laissez faire, deficit spending, etc.).
 - b. Explain the emergence of modern America from a domestic perspective (e.g., frontier experience, Industrial Revolution and organized labor, reform movements of Populism and Progressivism, Women’s Movement, Civil Rights Movement, the New Deal, etc.).
 - c. Explain the changing role of the United States in world affairs since 1877 through wars, conflicts, and foreign policy (e.g., Spanish-American War, Korean conflict, containment policy, etc.).
 - d. Trace the expansion of the United States and its acquisition of territory from 1877 (e.g., expansionism and imperialism).
- H2 Describe the impact of science and technology on the historical development of the United States in the global community.
- a. Analyze the impact of inventions on the United States (e.g., telephone, light bulb, etc.).
 - b. Examine the continuing impact of the Industrial Revolution on the development of our nation (e.g., mass production, computer operations, etc.).

⁵ *Mississippi social studies framework—U.S. History from 1877*. (2003). Retrieved September 10, 2003, from http://marcopolo.mde.k12.ms.us/frameworks/social_studies/ss_us_history.html

- c. Describe the effects of transportation and communication advances since 1877.
- H3 Describe the relationship of people, places, and environments through time.
- a. Analyze human migration patterns since 1877 (e.g., rural to urban, the Great Migration, etc.).
 - b. Analyze how changing human, physical, geographic characteristics can alter a regional landscape (e.g., urbanization, Dust Bowl, etc.).
- H4 Demonstrate the ability to use social studies tools (e.g., timelines, maps, globes, resources, graphs, a compass, technology, etc.).
- a. Interpret special purpose maps, primary/secondary sources, and political cartoons.
 - b. Analyze technological information on graphs, charts, and timelines.
 - c. Locate areas of international conflict (e.g., Caribbean, Southeast Asia, Europe, etc.).
- H5 Analyze the contributions of Americans to the ongoing democratic process to include civic responsibilities.
- a. Examine various reform movements (e.g., Civil Rights, Women's Movement, etc.).
 - b. Examine the government's role in various movements (e.g., arbitration, 26th Amendment, etc.).
 - c. Examine the role of government in the preservation of citizens' rights (e.g., 19th Amendment, Civil Rights Act of 1964).
 - d. Examine individuals' duties and responsibilities in a democratic society (e.g., voting, volunteerism, etc.).

Appendix C: Workplace Skills for the 21st Century⁶

- WP1 Allocates resources (time, money, materials and facilities, and human resources).
- WP2 Acquires, evaluates, organizes and maintains, and interprets/communicates information, including the use of computers.
- WP3 Practices interpersonal skills related to careers including team member participation, teaching other people, serving clients/customers, exercising leadership, negotiation, and working with culturally diverse.
- WP4 Applies systems concept including basic understanding, monitoring and correction system performance, and designing and improving systems.
- WP5 Selects, applies, and maintains/troubleshoots technology.
- WP6 Employs thinking skills including creative thinking, decision making, problem solving, reasoning, and knowing how to learn.
- WP7 Basic Skills: Employs basic academic skills including reading, writing, arithmetic and mathematics, speaking, and listening.
- WP8 Personal Qualities: Practices work ethics related to individual responsibility, integrity, honesty, and personal management.

⁶ Secretary's commission on achieving necessary skills. Retrieved July 13, 2004, from <http://wdr.doleta.gov/SCANS/>

Appendix D: National Educational Technology Standards for Students⁷

- T1 Basic operations and concepts
- Students demonstrate a sound understanding of the nature and operation of technology systems.
 - Students are proficient in the use of technology.
- T2 Social, ethical, and human issues
- Students understand the ethical, cultural, and societal issues related to technology.
 - Students practice responsible use of technology systems, information, and software.
 - Students develop positive attitudes toward technology uses that support lifelong learning, collaboration, personal pursuits, and productivity.
- T3 Technology productivity tools
- Students use technology tools to enhance learning, increase productivity, and promote creativity.
 - Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.
- T4 Technology communications tools
- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
 - Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- T5 Technology research tools
- Students use technology to locate, evaluate, and collect information from a variety of sources.
 - Students use technology tools to process data and report results.
 - Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.
- T6 Technology problem-solving and decision-making tools
- Students use technology resources for solving problems and making informed decisions.
 - Students employ technology in the development of strategies for solving problems in the real world.

⁷ International Society for Technology in Education. (2000). *National educational technology standards for students (NETS)*. Retrieved July 13, 2004, from <http://www.iste.org/>

Appendix E: Evaluations and Rubrics for Small Engine Repair

WRITTEN REPORT EVALUATION

- _____/16 Preparation
- _____/28 Organization
- _____/24 Thoroughness
- _____/19 Extra Materials
- _____/13 Final Report

Preparation

1. ____/2 Information written (neatly)
2. ____/2 Sources used listed
3. ____/5 Worked every day (did not waste time)
4. ____/5 Has all materials ready for use
5. ____/2 Cooperative

Organization

1. ____/2 Report in a logical order
2. ____/2 Interesting manner
3. ____/2 Notebook check
4. ____/2 Understanding of topic
5. ____/2 Spelling and sentence structure (do not copy from books)

Thoroughness

1. ____/5 Main points given
2. ____/5 Details to explain given
3. ____/5 Information presented clearly
4. ____/4 More than one source used
5. ____/5 Extra materials are appropriate

Extra Materials

1. ____/2 Neatness
2. ____/7 Creativity
3. ____/2 Dramatic value
4. ____/3 Useful
5. ____/5 Correctness

Final Report

1. ____/3 Written clearly
2. ____/2 Organized
3. ____/2 Sources documented correctly
4. ____/2 Spelling
5. ____/2 Grammar
6. ____/2 Neatness

_____/100 Total points earned

PRESENTATION EVALUATION

- _____/16 Preparation
 _____/28 Organization
 _____/24 Thoroughness
 _____/19 Extra Materials
 _____/13 Actual Presentation

Preparation:

1. _____/2 Information written (neatly)
2. _____/2 Sources used listed
3. _____/5 Worked every day (did not waste time)
4. _____/5 Has all materials ready for use
5. _____/2 Cooperative

Organization

1. _____/2 Report in a logical order
2. _____/2 Interesting manner
3. _____/2 Notebook check
4. _____/2 Understanding of topic
5. _____/2 Spelling and sentence structure (do not copy from books)

Thoroughness

1. _____/5 Main points given
2. _____/5 Details to explain given
3. _____/5 Information presented clearly
4. _____/4 More than one source used
5. _____/5 Extra materials are appropriate

Extra Materials

1. _____/2 Neatness
2. _____/7 Creativity
3. _____/2 Dramatic value
4. _____/3 Useful
5. _____/5 Correctness

Actual Presentation

1. _____/3 Speaks clearly and distinctly
2. _____/2 Uses extra materials effectively
3. _____/2 Posture
4. _____/2 Pronounces all words correctly
5. _____/2 Organized in thought
6. _____/2 Rate

_____/100 Total points earned

Role Play or Skit Rubric

	Excellent 4 Points	Good 3 Points	Average 2 Points	Needs Improvement 1 Point	Total
Accuracy	All information was accurate	Almost all information was accurate	Most information was accurate	Very little information was accurate	
Role	Excellent character development; student contributed in a significant manner	Good character development; student contributed in a cooperative manner	Fair character development; student may have contributed	Little or no character development; student did not contribute much at all	
Knowledge Gained	Can clearly explain several ways in which his/her character "saw" things differently than other characters and can explain why	Can clearly explain several ways in which his/her character "saw" things differently than other characters	Can clearly explain one way in which his/her character "saw" things differently than other characters	Cannot explain any way in which his/her character "saw" things differently than other characters	
Props	Used several props and showed considerable creativity	Used 1 or 2 appropriate props that made the presentation better	Used 1 or 2 props that made the presentation better	Used no props to make the presentation better	
Required Elements	Included more information than required	Included all required information	Included most required information	Included less information than required	

Resume Rubric

	Excellent 25 Points	Well Done 20 Points	Meets Standards 15 Points	Beginning 10 Points	No Evidence 0 Points	Score
Format	Resume contains name, address, objective, education, experience, and references. All words spelled correctly	Contains at least 6 of the criteria, no more than two spelling errors	Contains at least 5 of the criteria, no more than four spelling errors	Contains minimal information, more than four spelling errors	Assignment was not submitted	
Education	Education includes all schools attended, graduation dates, diploma/degree awarded, and major field of study	Education includes three of the criteria	Education includes two of the criteria	Education includes one of the criteria	Assignment was not submitted	
Experience	Experience includes internships, entry level jobs, current position	Experience includes two of the criteria	Experience includes one of the criteria	Experience includes current position only	Assignment was not submitted	
Factual	Contains factual names and dates, is believable	Resume is fairly believable with factual names or dates	Resume has unrealistic dates or names	Resume is unrealistic and contains conflicting information	Assignment was not submitted	

Performance Rubric

Student Name _____ Date _____

Task to be performed _____

	Possible Points	Points Awarded
Safety Personal safety (glasses, clothing, etc.) Safe use of tool Safely performs the task	25	
Performance of the Task Follows the task instructions Performs the task efficiently Performs the task satisfactorily	50	
Lab Maintenance Area clean-up (clean and tidy) Area organization (before, during, and after the task)	25	
Total	100	

Comments for deductions:

Instructor's Signature _____