

## 2011 Mississippi Curriculum Framework

### Postsecondary Small Engine and Equipment Repair Technology

(Program CIP: 01.0299 Agricultural Mechanization, Other )

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Engine and Equipment Program

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

### Proposed Standards for Mississippi Postsecondary Small Engine and Equipment Repair Technology Programs

Industry standards for Small Engine Repair courses were adapted from the publication, *Program Assessment Manual: Power Equipment Technology*, as published by the Equipment and Engine Training Council. For more information see the Council's Web site at [www.eetc.org](http://www.eetc.org)

### Related Academic Standards

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## Preface

### Postsecondary Small Engine and Equipment Repair Technology Research Synopsis

Articles, books, Web sites, and other materials listed at the end in each course were considered during the revision process. Resources from the Equipment and Engine Training Council were especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from colleges throughout the state were asked to give input related to changes to be made to the curriculum framework. Instructors from colleges throughout the state were also asked to give input on changes to be made to the curriculum framework.

### Needs of the Future Workforce

Employment of small engine mechanics is expected to grow slower than average, 4%, in the United States. However, in Mississippi the employment of small engine mechanics is projected to grow faster than average 17%, between 2010 and 2020 (EMSI, 2010). Job prospects will be best for those with formal postsecondary education and training. In addition to growth from new employment, many job openings will result from the need to replace mechanics transferring occupations and retiring experienced workers (United States Department of Labor Statistics, 2010).

### *Small Engine and Equipment Repair Technology Employment Projections and Earnings*

Region	2010 Jobs	2020 Jobs	Change	% Change	Openings	2010 Median Hourly Earnings
Regional Total	401	471	70	17%	162	\$10.33
National Total	38,925	40,298	1,373	4%	11,199	\$12.56

### Curriculum

The following national standards were referenced in each course of the curriculum:

- CTB/McGraw-Hill LLC *Tests of Adult Basic Education, forms 9 and 10* Academic Standards
- *21st Century Skills*
- *Equipment and Engine Training Council Standards*

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process; changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the curriculum revision meeting included the following:

- Competencies and objectives were reviewed to ensure accuracy and appropriateness.
- The Recommended Tools and Equipment list was updated.
- Content of all courses was realigned with title of each course.
- Course Prefix was changed to reflect the true nature of the program.
- Several courses were added: Small Engine and Equipment Project I, II, III, and IV.

### Assessment

Students will be assessed using the *Small Engine and Equipment Repair Technology* MS-CPAS2 test. The MS-CPAS2 blueprint can be found at <http://www.rcu.msstate.edu/>. All students will test after year one of their program. A second test covering the second year material will be administered to AAS track students upon completion of their program. If there are questions regarding assessment of this program, please contact the Agriculture Instructional Design Specialist at the Research and Curriculum Unit at 662.325.2510.

There is no alternate assessment at this time.

### Professional Learning

It is suggested that instructors participate in professional learning related to the following concepts:

- Differentiated instruction – To learn more about differentiated instruction, please go to [http://www.paec.org/teacher2teacher/additional\\_subjects.html](http://www.paec.org/teacher2teacher/additional_subjects.html), and click on Differentiated Instruction. Work through this online course, and review the additional resources.

### Program Exceptions

No program exceptions exist at this time.

### Articulation

Articulation credit from Secondary Small Engine Repair to Postsecondary Small Engine and Equipment Repair Technology will be awarded upon implementation of this curriculum by the college. The course to be articulated is SET 1413 – Small Engine Shop Management with the stipulation of passing the MS-CPAS2 according to State Board for Community and Junior Colleges (MCCB) guidelines.

Articulated Secondary Course	Articulated Postsecondary Course
[S] Agriculture Power and Machinery (CIP: 01.0204) [S] Small Engine Repair (CIP: 47.0606)	SET 1413 – Small Engine Shop Management

### Statewide Guidelines on Articulated Credit

#### *Eligibility*

- To be eligible for articulated credit, a student must do the following:
  - Complete the articulated Secondary Career Program.
  - Score 80% or higher on the Mississippi Career Planning and Assessment System (MS CPAS) in his or her secondary program of study.
- To be awarded articulated credit, a student must do the following:
  - Complete application for articulated credit at the community or junior college.
  - Enroll in the community or junior college within 18 months of graduation.
  - Successfully complete 12 non-developmental career/technical or academic credit hours in the corresponding articulated postsecondary career-technical program of study.

*How MS CPAS will be documented*

- The Research and Curriculum Unit of Mississippi State University will provide the SBCJC a list of all secondary CTE students scoring at or above the 80 percentile for the articulated programs.
- The SBCJC will forward the list of students eligible for articulated credit to the colleges.

*Transcripting of Articulated Credit*

- Students must complete 12 non-developmental career/technical or academic credit hours in the articulated postsecondary career-technical program of study before the articulated credit is transcripted.
- No grade will be given on the transcript for articulated courses; only hours granted will be transcripted (thus resulting in no change in quality points).

*Time Limit*

- MS CPAS scores will be accepted to demonstrate competencies for up to 18 months after high school graduation.

*Cost*

- No costs will be assessed on hours earned through articulated credit.

## Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Career–technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact local career–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and career skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide career and technical educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Referenced throughout the courses of the curriculum are the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. Another important aspect of learning and working in the 21st century involves technology skills. The International Society for Technology in Education, developer of the National Educational Technology Standards (NETS), was a strategic partner in the Partnership for 21st Century Skills. Each postsecondary program of instruction consists of a program description and a suggested sequence of courses that focus on the development of occupational competencies. The MS-CPAS2 blueprints are based upon the suggested course sequences to allow for year 1 and year 2 assessments for all exit options. Please refer to the blueprint online. Each career–technical course in this sequence has been written using a common format, which includes the following components:

- Course Name – A common name that will be used by all community and junior colleges in reporting students
- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students
- Classification – Courses may be classified as the following:
  - Career–technical core – A required career–technical course for all students
  - Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
  - Career–technical elective – An elective career–technical course
  - Related academic course – An academic course that provides academic skills and knowledge directly related to the program area

- Academic core – An academic course that is required as part of the requirements for an associate’s degree
- Description – A short narrative that includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester
- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course
- Corequisites – A listing of courses that may be taken while enrolled in the course
- Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and the suggested student objectives that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
  - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
  - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
  - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
  - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas
- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.
- Programs that offer an Associate of Applied Science degree must include a minimum 15-semester-credit-hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:
  - 3 semester credit hours (sch)                      Math/Science Elective
  - 3 semester credit hours                              Written Communications Elective
  - 3 semester credit hours                              Oral Communications Elective
  - 3 semester credit hours                              Humanities/Fine Arts Elective



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## Program Description

Small Engine and Equipment Repair Technology is designed to provide students with entry-level skills needed to compete in today's small engine and equipment repair industry. Training is provided in the areas of Engine Repair, Diagnostic skills, Cutting Systems, Chassis Repair, Electrical Systems, and Shop Management Skills. Students may earn a technical certificate in Small Engine and Equipment Repair by completing a minimum of 35 hours of required SET courses. Students desiring to earn an Associate of Applied Science degree in Small Engine and Equipment Repair must earn an additional 32 hours including required academic courses and approved electives.

Courses in the program have been correlated to standards for small engine and equipment repair programs as published by the Equipment and Engine Training Council, a nationally recognized association for the outdoor power equipment industry.

**Certificate Suggested Course Sequence\***  
**Small Engine and Equipment Repair Technology**  
**Career Certificate**

4 sch Small Engine Mechanics I (SET 1114) 3 sch Small Engine Electrical Systems (SET 2613 ) 2 sch Measurements (SET 1212) 3 sch Four-Cycle Engines (SET 1313) 3 sch Maintenance and Repair of Cutting Mechanisms (SET 2523) 2 sch Elective(s)	3 sch Small Engine Shop Management (SET 1413) 4 sch Small Engine Mechanics II (SET 1124) 2 sch Two-Cycle Engines(SET 1322) 2 sch Frame Inspection and Maintenance (SET 1512) 3 sch Transmissions and Transaxles (SET 2543) 3 sch Engine Troubleshooting (SET 2353)
17 sch	17 sch

SUMMER TERM

1-6 sch Supervised Work Experience in Small Engine and Engine Technology (SET 291-6)

Or

5 sch Small Engine and Equipment Analysis and Repairs I (SET 2155)

\* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

**Suggested Course Sequence\***  
**Small Engine and Equipment Repair Technology**  
**Associate of Applied Science**

FIRST YEAR

4 sch Small Engine Mechanics I (SET 1114) 2 sch Measurements (SET 1212) 3 sch Four-Cycle Engines (SET 1313) 3 sch Written Communications 3 sch Elective(s)	3 sch Small Engine Shop Management (SET 1413) 4 sch Small Engine Mechanics II (SET 1124) 2 sch Two-Cycle Engines (SET 1322) 2 sch Frame Inspection and Maintenance (SET 1512) 3 sch Math/Science Elective 3 sch Computer Elective
15 sch	17 sch

SUMMER TERM

1-6 sch Supervised Work Experience in Small Engine and Equipment Repair Technology (SET 2911-6)

Or

5 sch Small Engine and Equipment Analysis and Repairs I (SET 2155)

SECOND YEAR

3 sch Small Engine Electrical Systems (SET 2613) 3 sch Maintenance and Repair of Cutting Mechanisms (SET 2523) 3 sch Hydraulics (SET 2533) 4 sch Small Engine Mechanics III (SET 2134) 3 sch Social Behavioral Science Elective	3 sch Engine Troubleshooting (SET 2353) 4 sch Small Engine Mechanics IV (SET 2144) 3 sch Transmissions and Transaxles (SET 2543 ) 3 sch Oral Communications Elective 3 sch Spanish Elective
16 sch	16 sch

\* Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

\*\*\*APPROVED ELECTIVES

SET 281(1-3)	Special Problem in Small Engine and Equipment Repair Technology
SET 2165	Small Engine and Equipment Analysis and Repairs II
SET 2313	Small Engine and Equipment Projects I
SET 2323	Small Engine and Equipment Projects II
SET 2333	Small Engine and Equipment Projects III
SET 2343	Small Engine and Equipment Projects IV
SET 291(1-6)	Supervised Work Experience in Small Engine and Equipment Repair
ATE 1213	Conversational Spanish
BOT 1433	Business Accounting or ACC 1213 Principles of Accounting
BOT 1313	Applied Business Math or BAD 1313 Business Mathematics
BAD 2413	Legal Environment of Business
EDU/RSV 1312	Freshman Orientation
HLT 1222	Green Industry Seminar
HLT 1411	Leadership Management I
HLT 1421	Leadership Management II
HLT 1431	Leadership Management III
HLT 1441	Leadership Management IV
HLT 1614	Landscape Equipment Operation and Maintenance
HLT 2113	Turfgrass Management
PHY 1214	Survey of Physics
WBL 191(1-3)	Work Based Learning

(Other courses may be approved by the instructor when they can be shown to relate to the student's career pathway.)

## Small Engine and Equipment Repair Technology Courses

**Course Name:** Small Engine Mechanics I

**Course Abbreviation:** SET 1114

**Classification:** Career-Technical Core (Certificate and associates)

**Description:** Introduces students to the basic principles of engine mechanics. Includes instruction on lubrication, fuel, and ignition systems (4 sch: 0-hr lecture, 8-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Apply personal and shop safety standards associated with engines. (DOK1, EEC100, EEC200, EEC300) <ol style="list-style-type: none"> <li>a. Describe and apply rules and procedures for personal safety when working on an engine. (DOK1)</li> <li>b. Describe and apply rules and procedures for general shop safety when working on an engine. (DOK1)</li> </ol> <p>(NOTE: Personal safety will be stressed and monitored on a continuous basis throughout all courses in the program.)</p>
2.	Describe the components of the lubrication, fuel and ignition systems. (DOK1, EEC100, EEC200, EEC300) <ol style="list-style-type: none"> <li>a. Identify and differentiate among the different types of lubrication systems, fuel systems and ignition systems commonly found on small engines. (DOK1)</li> <li>b. Select lubricants by grade and viscosity. (DOK1)</li> <li>c. Inspect and service the components of a crankcase ventilation system, fuel system and ignition system. (DOK1)</li> </ol>

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems, and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

R1 Interpret Graphic Information (forms, maps, reference sources)

- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy

- CS11 ICT Literacy
- CSS4-Life and Career Skills
- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

## SUGGESTED REFERENCES

### Books

- Equipment and Engine Training Council. (2009). *Four stroke study guide – power equipment technology*. Hartland, WI: Author.
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- Schuster, W. (1999). *Small engine technology*. Florence, KY: Thompson Learning.

### Journals

- Compact Equipment*. Peninsula, OH: Benjamin Media.
- Landscape Management*. Newton, MA: Questex Media.
- Lawn and Landscape*. Cleveland, OH: G.I.E. Media.

## Videos

Goodheart-Willcox. (n.d.). *Small gas engines construction and operation* [Videotape]. Tinley Park, IL: Author

Goodheart-Willcox. (n.d.). *Small gas engines disassembly* [Videotape]. Tinley Park, IL: Author

Goodheart-Willcox. (n.d.). *Small gas engines reassembly* [Videotape]. Tinley Park, IL: Author

**Course Name:** Small Engine Mechanics II

**Course Abbreviation:** SET 1124

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A continuation of Small Engine Mechanics I with emphasis on cooling systems, engine governance, multi-cylinder engines, and diesel fuel systems (4 sch: 0-hr lecture, 8-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Analyze and apply theories and principles related to engine cooling systems. (DOK3, EEC100, EEC300)	<ul style="list-style-type: none"> <li>a. Identify the components of an air cooled engine cooling system and their functions. (DOK1)</li> <li>b. Inspect, service, and repair as needed an air cooled engine cooling system. (DOK3)</li> <li>c. Identify the components of a liquid coolant system and their functions. (DOK1)</li> <li>d. Inspect, service, and repair a liquid coolant system to include testing coolant, pressure testing the system, and flushing the system. (DOK3)</li> </ul>
2. Inspect and apply theories and principles related to multi-cylinder engines. (DOK3, EEC100, EEC300)	<ul style="list-style-type: none"> <li>a. Inspect, test, and repair or replace the fuel intake system. (DOK3)</li> <li>b. Inspect, test, and repair or replace valve train components. (DOK3)</li> <li>c. Inspect, test, and repair or replace cylinder heads. (DOK3)</li> <li>d. Inspect, test, and repair or replace engine block components (pistons, cylinders, crankshaft, connection rods, bearings, seals, etc.). (DOK3)</li> <li>e. Inspect, test, service, and repair/replace a pressurized lubrication system. (DOK3)</li> <li>f. Inspect, service, and repair/replace exhaust systems components. (DOK3)</li> <li>g. Inspect, service, and replace as needed emission control system devices. (DOK3)</li> <li>h. Inspect, service, and replace as needed monitoring devices such as oil pressure, coolant temperature, and electrical system gages and sensors. (DOK3)</li> <li>i. Disassemble, inspect, repair, or replace components, and reassemble a multi-cylinder engine. (DOK3)</li> </ul>
3. Inspect and apply theories and principles related to diesel engine service and repair. (DOK3, EEC100, EEC300)	<ul style="list-style-type: none"> <li>a. Describe the basic theories of diesel engine operation to include compression ignition, direct fuel injection, engine design, and so forth. (DOK1)</li> <li>b. Identify the components of a typical diesel fuel injection system, and describe their functions and operation. (DOK1)</li> <li>c. Inspect, test, service, and/or replace diesel engine starting system aids including glow plugs and fuel heaters. (DOK3)</li> <li>d. Inspect, test, service, and/or repair the air induction system. (DOK3)</li> <li>e. Describe the operations and functions of power enhancers such as turbo chargers and super chargers. (DOK1)</li> <li>f. Describe precautions and procedures for safely storing diesel fuels. (DOK1)</li> </ul>

- g. Service a diesel engine fuel system to include replacing filters and bleeding the system. (DOK1)
- h. Inspect, test, and replace fuel injectors if necessary. (DOK3)

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems, and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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### *21st Century Skills*

CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy
- CSS2-Learning and Innovation Skills
  - CS6 Creativity and Innovation
  - CS7 Critical Thinking and Problem Solving
  - CS8 Communication and Collaboration
- CSS3-Information, Media and Technology Skills
  - CS9 Information Literacy
  - CS10 Media Literacy
  - CS11 ICT Literacy
- CSS4-Life and Career Skills
  - CS12 Flexibility and Adaptability
  - CS13 Initiative and Self-Direction
  - CS14 Social and Cross-Cultural Skills
  - CS15 Productivity and Accountability
  - CS16 Leadership and Responsibility

## SUGGESTED REFERENCES

### Books

- Equipment and Engine Training Council. (2009). *Four stroke study guide – power equipment technology*. Hartland, WI: Author.
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### Journals

*Compact Equipment*. Peninsula, OH: Benjamin Media.

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### Videos

Goodheart-Willcox. (n.d.). *Small gas engines construction and operation* [Videotape]. Tinley Park, IL: Author

Goodheart-Willcox. (n.d.). *Small gas engines disassembly* [Videotape]. Tinley Park, IL: Author

Goodheart-Willcox. (n.d.). *Small gas engines reassembly* [Videotape]. Tinley Park, IL: Author

**Course Name:** Measurements

**Course Abbreviation:** SET 1212

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge related to measurement tools, measurement tool usage, and fasteners of small engine and equipment components (2 sch: 1-hr lecture, 2-hr lab)

**Prerequisites:** None

### Competencies and Suggested Objectives

1. Identify and describe tools/equipment, measurement practices, and fasteners for working in a shop/lab and industry. <sup>(DOK1, EEC100, EEC200, EEC300)</sup>
  - a. Measure the length of an object using a rule to the nearest 1/16 in. and 1 mm. <sup>(DOK1)</sup>
  - b. Measure the inside diameter, outside diameter, and/or depth to the nearest 0.001 in. and nearest 0.1 mm, using precision measuring instruments (micrometers, calipers, and dial indicators). <sup>(DOK1)</sup>
  - c. Locate service specifications and information, using both print and computerized service information references (VIN, certification, and calibration labels). <sup>(DOK1)</sup>
  - d. Identify and demonstrate the safe and proper use of impact wrenches; drills; grinders; hydraulic presses; lifting and hoisting equipment; cleaning equipment; common hand tools including wrenches, sockets, pliers, screwdrivers, and striking tools; and other tools used in the outdoor power equipment industry. <sup>(DOK1)</sup>
  - e. Organize and maintain a systematic storage system for hand and power tools. <sup>(DOK1)</sup>
  - f. Identify the different types of bolts, nuts, and washers, and describe their appropriate uses. <sup>(DOK1)</sup>
  - g. Identify bolts by grade, diameter, length, and thread pitch. <sup>(DOK1)</sup>
  - h. Identify and describe the use of various glues and sealants. <sup>(DOK1)</sup>
  - i. Restore internal and external threads. <sup>(DOK1)</sup>

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

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*Related Academic Standards*


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- R1 Interpret Graphic Information (forms, maps, reference sources)
- R3 Recall Information (details, sequence)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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*21st Century Skills*


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CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

**SUGGESTED REFERENCES**

## Books

- Radcliff, R., & Roark, D. (2003). *Small engines* (3rd ed.). Homewood, IL: American Technical.
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- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.
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- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar.

## Web sites

- Lincoln Electric Co. (2010). *Education Center*. Retrieved October 21, 2011, from <http://www.lincolnelectric.com/en-us/education-center/Pages/education-center.aspx>
- Miller Electric Manufacturing Co. (2010). *Welding library*. Retrieved October 21, 2010, from <http://millerwelds.com/education/library.html>
- Thermadyne Inc. (2010). *Victor professional*. Retrieved October 21, 2010, from <http://thermadyne.com/victor/>

**Course Name:** Four-Cycle Engines

**Course Abbreviation:** SET 1313

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge related to four-cycle small engine and equipment repair and maintenance. Includes instruction in assembly, lubrication, and fuel systems (3 sch: 2-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Describe and discuss basic principles of four-cycle engine operation. (DOK3, EEC100, EEC200, EEC300)	<ul style="list-style-type: none"> <li>a. Identify the major systems of an engine and their function or purpose. (DOK1)</li> <li>b. Discuss the sequence of events in a typical four-stroke cycle engine. (DOK1)</li> <li>c. Differentiate between two-stroke cycle and four-stroke cycle engines and their components. (DOK1)</li> <li>d. Disassemble, inspect/test components (replace as necessary), and reassemble a single cylinder two-stroke cycle and a single cylinder four-stroke cycle engine. (DOK1)</li> <li>e. Identify the different types of governing system, and describe how they operate. (DOK1)</li> <li>f. Inspect, service, and repair if necessary a pneumatic governor. (DOK3)</li> <li>g. Inspect, service, and repair if necessary a mechanical governor. (DOK3)</li> <li>h. Identify the major systems of a four-cycle engine and their function or purpose. (DOK1)</li> <li>i. Discuss the sequence of events in a typical four-stroke cycle engine. (DOK1)</li> <li>j. Disassemble, inspect/test components (replace as necessary), and reassemble a single cylinder four-stroke cycle engine. (DOK2)</li> </ul>
2. Describe the components of the four-cycle basic engine assembly. (DOK1, EEC100, EEC300)	<ul style="list-style-type: none"> <li>a. Identify components of the engine block and the reciprocating assembly. (DOK1)</li> <li>b. Identify components of the valve train. (DOK1)</li> </ul>
3. Describe the components of the four-cycle engine lubrication system. (DOK1, EEC100, EEC300)	<ul style="list-style-type: none"> <li>a. Identify and differentiate among the different types of lubrication systems commonly found on four-cycle engines. (DOK1)</li> <li>b. Select lubricants by grade and viscosity. (DOK1)</li> <li>c. Inspect and service the components of a crankcase ventilation system. (DOK1)</li> <li>d. Identify components of the engine block and the reciprocating assembly. (DOK1)</li> <li>e. Identify components of the valve train. (DOK1)</li> </ul>
4. Describe components of the four-cycle gasoline fuel system. (DOK1, EEC100, EEC300)	<ul style="list-style-type: none"> <li>a. Describe the selection and storage of different fuels for four-stroke cycle engines. (DOK1)</li> <li>b. Test a fuel mixture for alcohol contamination. (DOK1)</li> <li>c. Identify components of a carburetor-type fuel system and their functions. (DOK1)</li> <li>d. Remove, disassemble, service, and reassemble carburetors. (DOK2)</li> <li>e. Service the fuel supply system (fuel tank, pump, lines, and filters). (DOK2)</li> <li>f. Service electronic fuel injection systems. (DOK2)</li> <li>g. Service air filtering systems including foam-type, pleated paper, oil bath, and canister</li> </ul>

systems. (DOK2)
5. Describe and service the four-cycle engine ignition system. (DOK2, EEC100,EEC300)
a. Identify and describe the components of common ignition systems used in four-cycle engines including magneto, battery, and electronic systems. (DOK2)
b. Test and service ignition systems, including spark plugs, switches, conductors, and magnetos. (DOK3)

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R3 Recall Information (details, sequence)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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## 21st Century Skills

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### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

## SUGGESTED REFERENCES

### Books

- Radcliff, R., & Roark, D. (2003). *Small engines* (3rd ed.). Homewood, IL: American Technical.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.
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- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar.

### Web sites

- Lincoln Electric Co. (2010). *Education center*. Retrieved October 21, 2011, from <http://www.lincolnelectric.com/en-us/education-center/Pages/education-center.aspx>

Miller Electric Manufacturing Co. (2010). *Welding library*. Retrieved October 21, 2010, from <http://millerwelds.com/education/library.html>

Thermadyne Inc. (2010). *Victor professional*. Retrieved October 21, 2010, from <http://thermadyne.com/victor/>

**Course Name:** Two-Cycle Engines

**Course Abbreviation:** SET 1322

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge related to two-cycle small engine and equipment repair and maintenance. Includes instruction in assembly, lubrication, and fuel systems (2 sch: 1-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Describe and discuss basic principles of two-cycle engine operation. (DOK2, EEC100, EEC300) <ol style="list-style-type: none"> <li>Identify the major systems of a two-cycle engine and their function or purpose. (DOK1)</li> <li>Discuss the sequence of events in a typical two-stroke cycle engine. (DOK1)</li> <li>Disassemble, inspect/test components (replace as necessary), and reassemble a single cylinder two-stroke cycle engine. (DOK2)</li> </ol>
2.	Describe the components of the two-cycle basic engine assembly. (DOK1, EEC100, EEC300) <ol style="list-style-type: none"> <li>Identify components of the engine block and the reciprocating assembly. (DOK1)</li> <li>Identify components of the valve train. (DOK1)</li> </ol>
3.	Describe the components of the two-cycle engine lubrication system. (DOK1, EEC100, EEC300) <ol style="list-style-type: none"> <li>Identify and differentiate among the different types of lubrication systems commonly found on two-cycle engines. (DOK1)</li> <li>Select lubricants by grade and viscosity. (DOK1)</li> <li>Inspect and service the components of a crankcase ventilation system. (DOK1)</li> <li>Determine the proper mixture ratios. (DOK1)</li> <li>Properly demonstrate the correct method of mixing fuel for use in a two-cycle engine to the manufacturer's recommended specifications. (DOK2)</li> </ol>
4.	Describe components of the two-cycle gasoline fuel system. (DOK1, EEC100, EEC200, EEC300) <ol style="list-style-type: none"> <li>Describe the selection and storage of different fuels for two-stroke cycle engines. (DOK1)</li> <li>Test a fuel mixture for alcohol contamination. (DOK1)</li> <li>Identify components of a carburetor-type fuel system and their functions. (DOK1)</li> <li>Remove, disassemble, service, and reassemble carburetors. (DOK2)</li> <li>Service the fuel supply system (fuel tank, pump, lines, and filters). (DOK2)</li> <li>Service electronic fuel injection systems. (DOK2)</li> <li>Service air filtering systems including foam-type, pleated paper, oil bath, and canister systems. (DOK 1)</li> <li>Identify components of the engine block and the reciprocating assembly. (DOK1)</li> <li>Identify components of the valve train. (DOK1)</li> <li>Describe the selection and storage of different fuels for two-stroke and four-stroke cycle engines. (DOK1)</li> <li>Identify different classifications of two-cycle mixing oils. (DOK1)</li> <li>Prepare premixed fuel and oil solutions for a given two-stroke cycle engine. (DOK1)</li> <li>Test a fuel mixture for alcohol contamination. (DOK1)</li> <li>Identify components of a carburetor-type fuel system and their functions. (DOK1)</li> </ol>

<ul style="list-style-type: none"> <li>o. Remove, disassemble, service, and reassemble carburetors. <sup>(DOK1)</sup></li> <li>p. Service the fuel supply system (fuel tank, pump, lines, and filters). <sup>(DOK1)</sup></li> <li>q. Service electronic fuel injection systems. <sup>(DOK1)</sup></li> <li>r. Service air filtering systems including foam-type, pleated paper, oil bath, and canister systems. <sup>(DOK1)</sup></li> </ul>
<ul style="list-style-type: none"> <li>5. Describe and service the two-cycle engine ignition system. <sup>(DOK2, EEC100, EEC300)</sup> <ul style="list-style-type: none"> <li>a. Identify and describe the components of common ignition systems used in small engines including magneto, battery, and electronic systems. <sup>(DOK2)</sup></li> <li>b. Test and service ignition systems, including spark plugs, switches, conductors, and magnetos. <sup>(DOK3)</sup></li> </ul> </li> </ul>

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

R1	Interpret Graphic Information (forms, maps, reference sources)
R3	Recall Information (details, sequence)
M1	Addition of Whole Numbers (no regrouping, regrouping)
M2	Subtraction of Whole Numbers (no regrouping, regrouping)
M3	Multiplication of Whole Numbers (no regrouping, regrouping)
M4	Division of Whole Numbers (no remainder, remainder)
M5	Decimals (addition, subtraction, multiplication, division)
M6	Fractions (addition, subtraction, multiplication, division)
M7	Integers (addition, subtraction, multiplication, division)
M8	Percents
M9	Algebraic Operations
A1	Numeration (ordering, place value, scientific notation)
A2	Number Theory (ratio, proportion)
A3	Data Interpretation (graph, table, chart, diagram)
A4	Pre-Algebra and Algebra (equations, inequality)
A5	Measurement (money, time, temperature, length, area, volume)
A6	Geometry (angles, Pythagorean theory)
A7	Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8	Estimation (rounding, estimation)

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### 21st Century Skills

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

### SUGGESTED REFERENCES

#### Books

Radcliff, R., & Roark, D. (2003). *Small engines* (3rd ed.). Homewood, IL: American Technical.

Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.

Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.

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Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.

Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar

**Course Name:** Small Engine Shop Management

**Course Abbreviation:** SET 1413

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** Provides students with skills and knowledge related to management and operation of a small engine repair shop. Includes instruction in shop safety and OSHA regulations, shop tools and equipment, shop design, overall shop maintenance, and inventory control (3 sch: 2-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Apply personal safety practices and protective devices. (DOK1, EEC100, EEC200, EEC300)
a.	Identify and describe practices for safe lifting and transport of materials. (DOK1)
b.	Identify and describe the safe and proper use of personal safety equipment including ear, eye, and skin protection, personal clothing, and accessories. (DOK1)
c.	Apply precautions to prevent carbon monoxide poisoning. (DOK1)
d.	Describe and apply procedures for lock-out and tag-out operations. (DOK1)
e.	Associate the colors of the safety color code with hazardous conditions. (DOK1)
f.	Identify and apply fire safety procedures including selection of containment methods for different classes of fire and evacuation procedures. (DOK1)
g.	Describe and apply housekeeping practices to maintain a safe and an orderly workplace. (DOK1)
h.	Interpret hazardous materials safety data sheets (MSDS) to include type of hazard, precautions to follow in using the material, procedures for spills or leakage, and disposal. (DOK1)
i.	Identify and describe the functions of different agencies associated with safety and environmental concerns including OSHA, EPA, Mississippi Department of Environmental Quality, and local authorities. (DOK1)
j.	Perform supervisory duties associated with small engine repair shops including job assignment, supervision of other workers, work schedules, and so forth. (DOK1)
2.	Apply practices associated with repair shop operations. (DOK2, EEC100, EEC200, EEC300)
a.	Maintain an accurate parts inventory. (DOK1)
b.	Complete a work order. (DOK1)
c.	Locate and interpret engine identification numbers. (DOK1)
d.	Use labor and time guides to determine the cost of a job. (DOK1)
e.	Identify and order specific parts using Internet, microfiche, and manuals. (DOK1)
f.	Locate and interpret OEM specifications. (DOK1)
g.	Complete warranty registration and documentation. (DOK1)
h.	Define industry specific terms related to small engines. (DOK1)
i.	Apply and practice effective customer communication skills. (DOK1)
j.	Explain basic operation and safety precautions/devices on equipment to customers. (DOK1)

- |   |
|---|
| <p>3. Demonstrate the safe and proper use of hand and small power tools and equipment. <sup>(DOK2, EEC100, EEC200, EEC300)</sup></p> <p>a. Identify safety precautions and procedures to follow in cleaning equipment using steam, water pressure, and solvents. <sup>(DOK1)</sup></p> <p>b. Identify and use general hand tools (wrenches, screwdrivers, sockets, etc.) properly to include cleaning and storing. <sup>(DOK1)</sup></p> <p>c. Identify and use special tools associated with small engine component specific operations such as fly wheel pullers, seal drivers, torque wrenches, and so forth. <sup>(DOK1)</sup></p> <p>d. Use electrical tools and equipment such as drills, drill presses, drivers, and heat guns, safely and properly. <sup>(DOK1)</sup></p> <p>e. Use hydraulic presses, vises, and lifting/hoisting devices safely and properly. <sup>(DOK1)</sup></p> |
| <p>4. Describe career opportunities in small engine and equipment repair. <sup>(DOK1, EEC100, EEC200, EEC300)</sup></p> <p>a. Describe career pathways in small engine and equipment technology. <sup>(DOK1)</sup></p> <p>b. Identify professional certification programs for small engine and equipment technicians. <sup>(DOK1)</sup></p> <p>c. Identify opportunities for continuing education and training in small engine and equipment technology. <sup>(DOK1)</sup></p> <p>d. Discuss the role of professional and industry associations in small engine and equipment repair. <sup>(DOK1)</sup></p>   |

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)

- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

## SUGGESTED REFERENCES

### Books

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- Radcliff, R., & Roark, D. (2003). *Small engines* (3rd ed.). Homewood, IL: American Technical.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (workbook). Tinley Park, IL: Goodheart-Willcox.

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### Web sites

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- Deere and Company. (2010) *Golf and turf*. Retrieved October 21, 2010, from [http://www.deere.com/en\\_US/golfturf/index.html](http://www.deere.com/en_US/golfturf/index.html)
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**Course Name:** Frame Inspection and Maintenance

**Course Abbreviation:** SET 1512

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge related to small equipment frame (chassis) repair and maintenance. Includes instruction in oxyfuel cutting and arc welding as well as painting and other frame (chassis) maintenance (2 sch: 1-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Perform basic oxyfuel cutting operations. (DOK2, EEC100, EEC200, EEC300)	
a. Assemble an oxyfuel cutting torch unit to include attaching regulators and torch tips and checking for leaks and proper operation. (DOK1)	
b. Set up, light, and adjust an oxyfuel cutting torch to cut steel. (DOK1)	
c. Shut down an oxyfuel cutting torch to include bleeding the system. (DOK1)	
d. Use an oxyfuel cutting torch to cut various types of metal in various positions. (DOK2)	
e. Use an oxyfuel cutting torch to heat metal. (DOK)	
2. Perform basic electrical arc welding. (DOK2, EEC100, EEC200, EEC300)	
a. Identify and describe the use of different types of arc welders including type of metal that can be welded by each. (DOK1)	
b. Identify the different positions and types of welds. (DOK1)	
c. Set up an arc welder for a given welding job. (DOK2)	
d. Perform basic arc welding operations using shielded metal arc welding equipment. (SMAW) (DOK2)	
e. Perform basic arc welding operations using gas metallic arc welding equipment. (GMAW) (DOK2)	
3. Recondition and repair frame (chassis). (DOK2, EEC100, EEC200, EEC300)	
a. Identify areas on a frame (chassis) that can be repaired or reconditioned. (DOK1)	
b. Prepare frame (chassis) for painting. (DOK1)	
c. Spot paint a frame (chassis) repair. (DOK1)	

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

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*Related Academic Standards*


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- R1 Interpret Graphic Information (forms, maps, reference sources)
- R3 Recall Information (details, sequence)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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*21st Century Skills*


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CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

**SUGGESTED REFERENCES**

## Books

- Radcliff, R., & Roark, D. (2003). *Small engines* (3rd ed.). Homewood, IL: American Technical.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (workbook). Tinley Park, IL: Goodheart-Willcox.
- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
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## Web sites

- Lincoln Electric Co. (2010). *Education center*. Retrieved October 21, 2011, from <http://www.lincolnelectric.com/en-us/education-center/Pages/education-center.aspx>
- Miller Electric Manufacturing Co. (2010). *Welding library*. Retrieved October 21, 2010, from <http://millerwelds.com/education/library.html>
- Thermadyne Inc. (2010). *Victor professional*. Retrieved October 21, 2010, from <http://thermadyne.com/victor/>

**Course Name:** Small Engine Mechanics III

**Course Abbreviation:** SET 2134

**Classification:** Career-Technical Core (Associates)

**Description:** A continuation of Small Engine Mechanics II with emphasis on steering and suspension systems (4 sch: 0-hr lecture, 8-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Analyze and apply principles of troubleshooting on small engines and equipment. <sup>(DOK3, EEC100, EEC200, EEC300)</sup>
	<ul style="list-style-type: none"> <li>a. Troubleshoot a multi-cylinder engine. <sup>(DOK3)</sup></li> <li>b. Troubleshoot a diesel engine. <sup>(DOK3)</sup></li> </ul>
2.	Inspect and apply diagnostic procedures on steering and suspension system problems. <sup>(DOK3, EEC100, EEC200, EEC300)</sup>
	<ul style="list-style-type: none"> <li>a. Identify and describe the functions of the components of a manual steering system. <sup>(DOK1)</sup></li> <li>b. Identify and describe the functions of the components of a power assisted steering system. <sup>(DOK1)</sup></li> <li>c. Inspect, test, and adjust or replace steering system components. <sup>(DOK3)</sup></li> <li>d. Inspect, service, and replace if necessary, suspension system components including tires, wheels, bearings, springs, and shock absorbers. <sup>(DOK3)</sup></li> </ul>

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

**SUGGESTED REFERENCES**

## Books

- Industrial Training Zone. (2004). *Basic hydraulics: Fluid power training*. Lindon, UT: Author.
- John Deere Publishing. (2001). *Compact equipment: Power trains*. Moline, IL: Author.
- John Deere Publishing. (2006). *Fundamentals of service: Hydraulics*. Moline, IL: Author.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (workbook). Tinley Park, IL: Goodheart-Willcox.
- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar
- Vickers, Inc. (1992). *Vickers industrial hydraulics manual* (4th ed.). Eden Prairie, MN: Author.

**Course Name:** Small Engine Mechanics IV

**Course Abbreviation:** SET 2144

**Classification:** Career-Technical Core (Associates)

**Description:** A continuation of Small Engine Mechanics III with emphasis on troubleshooting and performing maintenance on a variety of systems (4 sch: 0-hr lecture, 8-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Apply general safety principles and safety requirements for working with landscape and turf equipment. (DOK1, EEC100, EEC200, EEC300)	
a. Apply principles of safety in the use and repair of charged systems. (DOK1)	
b. Identify, describe, and demonstrate the use of instruments/tools used to maintain and troubleshoot landscape and turf equipment. (DOK1)	
c. Describe the procedures for the maintenance and/or repair of landscape and turf equipment. (DOK1)	
2. Troubleshoot and perform basic maintenance of landscape and turf equipment. (DOK3, EEC100, EEC200, EEC300)	
a. List and describe functions of the major systems of landscape and turf equipment. (DOK1)	
b. Identify and describe charged systems and/or components. (DOK1)	
c. Troubleshoot all types of equipment used in and around the lawn, landscape, and turf industries, and analyze to determine failure. (DOK3)	
3. Troubleshoot transmission failure, troubleshoot transaxle failure, and troubleshoot Hydrostatic transaxle failure. (DOK3, EEC100, EEC200, EEC300)	
a. Remove, repair, and replace transmissions equipment. (DOK2)	
b. Remove, repair, and replace transaxles. (DOK2)	
c. Inspect remove and replace drive belts and chains. (DOK3)	
d. Check clutch operation. (DOK2)	
e. Inspect linkages. (DOK3)	

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems, and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

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*Related Academic Standards*


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- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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*21st Century Skills*


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CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation

- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration
- CSS3-Information, Media and Technology Skills
  - CS9 Information Literacy
  - CS10 Media Literacy
  - CS11 ICT Literacy
- CSS4-Life and Career Skills
  - CS12 Flexibility and Adaptability
  - CS13 Initiative and Self-Direction
  - CS14 Social and Cross-Cultural Skills
  - CS15 Productivity and Accountability
  - CS16 Leadership and Responsibility

## SUGGESTED REFERENCES

### Books

- John Deere Publishing. (2004). *Compact equipment: Electrical systems*. Moline, IL: Author.
- John Deere Publishing. (2004). *Compact equipment: Engines*. Moline, IL: Author.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.
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- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (workbook). Tinley Park, IL: Goodheart-Willcox.
- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar

### Videos

- Goodheart-Willcox. (n.d.). *Small gas engines troubleshooting/tune up* [Videotape]. Tinley Park, IL: Author.

**Course Name:** Small Engine and Equipment Analysis and Repairs I

**Course Abbreviation:** SET 2155

**Classification:** Career-Technical Elective

**Description:** A course to provide skills and knowledge related to the operation, troubleshooting, and repair of systems related to equipment. Includes instruction on a variety of equipment and troubleshooting techniques related to equipment (5 sch: 0-hr lecture, 10-hr lab)

**Prerequisites:** Consent of instructor

<b>Competencies and Suggested Objectives</b>	
1.	Apply proper safety procedures, and perform preventative maintenance regarding failure analysis and repair of equipment. (DOK3, EEC100, EEC200, EEC300)
	a. Develop a preventive maintenance program for a given piece of equipment. (DOK1)
	b. Inspect and adjust belts, chains, and other moving parts. (DOK3)
	c. Lubricate the equipment following manufacturer's recommendations. (DOK1)
2.	Troubleshoot and repair of equipment. (DOK3, EEC100, EEC200, EEC300)
	a. Identify symptoms that indicate equipment is not operating properly (excessive noise, vibration, heat, speed, etc.), and analyze to determine failure. (DOK3)
	b. Determine the cause of the symptoms. (DOK3)
	c. Inspect equipment for broken or worn parts, and determine if replacement is needed. (DOK3)
	d. Prepare a report on time and costs involved in repairing equipment. (DOK1)
	e. Disassemble, inspect, repair, and reassemble equipment to specifications. (DOK3)
	f. Perform preventive maintenance on equipment. (DOK1)

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems, and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)

- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

**SUGGESTED REFERENCES**

## Books

- Industrial Training Zone. (2004). *Basic hydraulics: Fluid power training*. Lindon, UT: Author.
- John Deere Publishing. (2001). *Compact equipment: Power trains*. Moline, IL: Author.
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- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar
- Vickers, Inc. (1992). *Vickers industrial hydraulics manual* (4th ed.). Eden Prairie, MN: Author.

**Course Name:** Small Engine and Equipment Analysis and Repairs II

**Course Abbreviation:** SET 2165

**Classification:** Career-Technical Elective

**Description:** A course to provide advanced skills and knowledge related to the operation, troubleshooting, and repair of systems related to equipment. Includes instruction on a variety of equipment and advanced troubleshooting techniques related to equipment. (5 sch: 0-hr lecture, 10-hr lab)

**Prerequisite:** Consent of instructor and completion of at least one semester of advanced coursework in Program Name

<b>Competencies and Suggested Objectives</b>	
1.	Apply proper safety procedures, and perform preventative maintenance regarding failure analysis and repair of equipment. (DOK2, EEC100, EEC200, EEC300)
a.	Develop a preventive maintenance program for a given piece of equipment. (DOK1)
b.	Inspect and adjust belts, chains, and other moving parts. (DOK3)
c.	Lubricate the equipment following manufacturer's recommendations. (DOK1)
2.	Demonstrate advanced troubleshooting techniques and repair of equipment. (DOK2, EEC100, EEC200, EEC300)
a.	Identify symptoms that indicate equipment is not operating properly (excessive noise, vibration, heat, speed, etc.), and analyze to determine failure. (DOK3)
b.	Determine the cause of the symptoms. (DOK3)
c.	Inspect equipment for broken or worn parts, and determine if replacement is needed. (DOK3)
d.	Prepare a report on time and costs involved in repairing equipment. (DOK1)
e.	Disassemble, inspect, repair, and reassemble equipment to specifications. (DOK3)
f.	Perform preventive maintenance on equipment. (DOK1)

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### *Equipment and Engine Training Council Standards*

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The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems, and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

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### *Related Academic Standards*

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- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)

- R3 Recall Information (details, sequence)
  - R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
  - R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
  - M1 Addition of Whole Numbers (no regrouping, regrouping)
  - M2 Subtraction of Whole Numbers (no regrouping, regrouping)
  - M3 Multiplication of Whole Numbers (no regrouping, regrouping)
  - M4 Division of Whole Numbers (no remainder, remainder)
  - M5 Decimals (addition, subtraction, multiplication, division)
  - M6 Fractions (addition, subtraction, multiplication, division)
  - M7 Integers (addition, subtraction, multiplication, division)
  - M8 Percents
  - M9 Algebraic Operations
  - A1 Numeration (ordering, place value, scientific notation)
  - A2 Number Theory (ratio, proportion)
  - A3 Data Interpretation (graph, table, chart, diagram)
  - A4 Pre-Algebra and Algebra (equations, inequality)
  - A5 Measurement (money, time, temperature, length, area, volume)
  - A6 Geometry (angles, Pythagorean theory)
  - A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
  - A8 Estimation (rounding, estimation)
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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

### **SUGGESTED REFERENCES**

## Books

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- John Deere Publishing. (2001). *Compact equipment: Power trains*. Moline, IL: Author.
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- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar
- Vickers, Inc. (1992). *Vickers industrial hydraulics manual* (4th ed.). Eden Prairie, MN: Author.

**Course Name:** Engine Troubleshooting

**Course Abbreviation:** SET 2353

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge associated with the basics of equipment diagnostics and trouble shooting. Instruction is provided on tools and equipment used in diagnosis, fasteners, fluids, and measurement devices. (3 sch: 2-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Demonstrate the use of special tools, equipment, and supplies used diagnosing and servicing small equipment. (DOK1, EEC100, EEC200, EEC300)	
a. Demonstrate the use of special tools and instruments used in diagnosing engine and equipment problems to include compression testers, leakdown testers, crankcase pressure testers, and tachometer. (DOK1)	
b. Demonstrate the use of measurement tools and instruments for diagnosis including rulers, micrometers, calipers, dial indicators, bore gages, and feeler gauges. (DOK1)	
c. Identify, describe the use of, and select fasteners including bolts (grade, thread, size, etc.), nuts, washers, wire ties, glues and adhesives, sealants, other specialty fasteners, pins, and keys. (DOK1)	
d. Repair and restore male and female threads. (DOK1)	
2. Apply principles of failure analysis related to engine performance. (DOK2, EEC100, EEC200, EEC300)	
a. Identify common causes of engine and equipment failure, and describe their characteristics. (DOK1)	
b. Differentiate between normal wear and abnormal wear. (DOK2)	
3. Apply principles of troubleshooting on small engines and equipment. (DOK2, EEC100, EEC200, EEC300)	
a. List the general steps in proper sequence for troubleshooting equipment. (DOK2)	
b. Troubleshoot a single cylinder two-cycle engine. (DOK 2)	
c. Troubleshoot a single cylinder four-cycle engine. (DOK2)	

## STANDARDS

### *Equipment and Engine Training Council Standards*

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems, and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

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*Related Academic Standards*


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- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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*21st Century Skills*


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CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation

- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration
- CSS3-Information, Media and Technology Skills
  - CS9 Information Literacy
  - CS10 Media Literacy
  - CS11 ICT Literacy
- CSS4-Life and Career Skills
  - CS12 Flexibility and Adaptability
  - CS13 Initiative and Self-Direction
  - CS14 Social and Cross-Cultural Skills
  - CS15 Productivity and Accountability
  - CS16 Leadership and Responsibility

## SUGGESTED REFERENCES

### Books

- John Deere Publishing. (2004). *Compact equipment: Electrical systems*. Moline, IL: Author.
- John Deere Publishing. (2004). *Compact equipment: Engines*. Moline, IL: Author.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (workbook). Tinley Park, IL: Goodheart-Willcox.
- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar

### Videos

- Goodheart-Willcox. (n.d.). *Small gas engines troubleshooting/tune up* [Videotape]. Tinley Park, IL: Author.

**Course Name:** Maintenance and Repair of Cutting Mechanisms

**Course Abbreviation:** SET 2523

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge related to the maintenance and repair of cutting mechanisms used in landscape and turf operations including mowers, trimmers, edgers, and saws. Includes instruction in drive systems, blade sharpening and height adjustment, reel grinding and adjustment, and chain saw chain sharpening and adjustment (3 sch: 2-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Compare features and uses of cutting devices used in landscape and turf maintenance. (DOK2, EEC100, EEC200)	<ul style="list-style-type: none"> <li>a. Compare and contrast the features and applications of rotary and reel mowers. (DOK2)</li> <li>b. Compare and contrast the different types of edgers. (DOK2)</li> <li>c. Identify and apply safety precautions in operating and repairing cutting equipment including personal protection. (DOK2)</li> <li>d. Diagnose height of cut/quality of cut issues including anti-scalping wheels, deck warpage, and level of deck, vacuum, and pressure on grass. (DOK3)</li> <li>e. Measure and level a deck. (DOK1)</li> </ul>
2. Inspect and repair rotary mowers. (DOK2, EEC100, EEC200)	<ul style="list-style-type: none"> <li>a. Identify the types of rotary mowers. (DOK1)</li> <li>b. Identify, inspect, and adjust/repair a rotary mower deck including pulleys and shafts, belts, mounts and brackets, leveling devices, and blade. (DOK3)</li> <li>c. Sharpen and balance a rotary mower blade using a side grinder, a bench grinder, and a commercial blade grinder. (DOK2)</li> </ul>
3. Inspect and repair reel mower assemblies. (DOK2, EEC100, EEC200)	<ul style="list-style-type: none"> <li>a. Identify the types of reel mowers and their applications. (DOK1)</li> <li>b. Identify, inspect, and adjust/repair the components of a reel mower assembly including reel, bed knife, supports, rollers, mounting hardware, bearings, and reel and bed knife adjustments. (DOK3)</li> <li>c. Describe the procedure for grinding a reel. (DOK1)</li> <li>d. Demonstrate the procedure for backlapping a reel. (DOK2)</li> </ul>
4. Inspect and repair trimmers and edgers. (DOK2, EEC100, EEC200)	<ul style="list-style-type: none"> <li>a. Identify the types of trimmers and edgers and their attachments and applications. (DOK1)</li> <li>b. Discuss selection of cutting string diameter and its effects. (DOK2)</li> <li>c. Inspect and replace if needs a clutch. (DOK2)</li> <li>d. Change a string trimmer head. (DOK1)</li> <li>e. Rewind a string trimmer head cartridge. (DOK1)</li> <li>f. Replace an edger blade. (DOK1)</li> </ul>

5. Inspect and repair/sharpen a chain saw bar and chain assembly. (DOK2, EEC100, EEC200)
- Identify the components of a chain and bar assembly. (DOK1)
  - Identify the different types of chains by pitch, cutter, and gauge and their effect on the saw operation. (DOK1)
  - Inspect a chain and bar assembly to include sharpening or replacing the chain, inspecting the bar and drive sprocket, reinstalling the bar and sprocket, and tensioning the chain. (DOK3)

## STANDARDS

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EEC100	Two and Four Stroke Gasoline Engines, Systems, and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)
- L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)

- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
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- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

## **SUGGESTED REFERENCES**

### Books

Foley United. (1996). *Grinding seminar*. River Falls, WI: Author.

MAVCC. (1999). *Power product: Lawn and garden equipment*. Stillwater, OK: Author.

Oregon Distribution. (2004). *Maintenance and safety manual for saw chain, guide bars, and drive sprockets*. Guelph, OR: Author.

Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.

Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.

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Schuster, W. (1998). *Small engine technology* (2nd ed.). Florence, KY: Thompson Learning.

Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.

Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar

#### Journals

Roche, M. (2004, April). Making chain saws run cleaner. *Tree Care Industry*, 15, 4.

#### Videos

Bishara, J., & Miller C. (n.d.). *Landscape power tools* [DVD]. Lubbock, TX: CEV Multimedia.

#### Web sites

Shindiawa, Inc. (2010). *Shindiawa outdoor power equipment*. Retrieved October 21, 2010, from <http://shindev.shindaiwa.com/>

**Course Name:** Hydraulics

**Course Abbreviation:** SET 2533

**Classification:** Career-Technical Core (Associates)

**Description:** A course to develop skills and knowledge related hydraulics as it relates to small equipment chassis repair and maintenance. Includes instruction on hydraulics will be components, diagnosis, and repair of the hydraulic system (3 sch: 2-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Describe and discuss basic principles of a hydraulic system operation. (DOK1, EEC200)	
a. Identify the major components of a hydraulic system. (DOK1)	
b. Discuss the function or purpose of a hydraulic system. (DOK1)	
c. Disassemble and inspect/test components of a hydraulic system. (DOK3)	
2. Inspect and evaluate general hydraulic system and components. (DOK2, EEC200)	
a. Discuss and demonstrate safety practices and concerns. (DOK2)	
b. Indentify causes of failure and corrections of hydraulic systems and their components. (DOK3)	
c. Identify and describe the function of the components listed below: (DOK2)	
• Dual drive systems	
• Actuator	
• Hoses	
• Control valve	
• Fitting	
• Connection	
• Pump	
• Filtration	
• Reservoirs	

## STANDARDS

### *Equipment and Engine Training Council Standards*

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EEC200 Drivelines/Hydraulics/Hydrostatic Systems and Components

### *Related Academic Standards*

R1 Interpret Graphic Information (forms, maps, reference sources)

- R3 Recall Information (details, sequence)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

**SUGGESTED REFERENCES**

## Books

- Radcliff, R., & Roark, D. (2003). *Small engines* (3rd ed.). Homewood, IL: American Technical.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (text). Tinley Park, IL: Goodheart-Willcox.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (workbook). Tinley Park, IL: Goodheart-Willcox.
- Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.
- Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar

**Course Name:** Transmissions and Transaxles

**Course Abbreviation:** SET 2543

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge related to small equipment transmissions and transaxles. Includes instruction for transmission and transaxle service, diagnosis, and repair (3 sch: 2-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1. Describe and discuss basic principles and components of transmission and transaxle operation. (DOK1, EEC200)	
a. Identify the major systems of a transmission/transaxle. (DOK1)	
b. Disassemble, inspect/test components (replace as necessary), and reassemble a transmission/transaxle. (DOK3)	
2. Explore the components of the transmission/transaxle lubrication system. (DOK2, EEC200)	
a. Identify and differentiate among the different types of lubrication systems commonly found on transmission/transaxle. (DOK1)	
b. Select lubricants by grade and viscosity. (DOK1)	
c. Inspect and service the components of a crankcase ventilation system. (DOK2)	

## STANDARDS

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EEC200      Drivelines/Hydraulics/Hydrostatic Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R3 Recall Information (details, sequence)
- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)

- M8 Percents
- M9 Algebraic Operations
- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

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### *21st Century Skills*

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#### CSS1-21st Century Themes

- CS1 Global Awareness
- CS2 Financial, Economic, Business, and Entrepreneurial Literacy
- CS3 Civic Literacy
- CS4 Health Literacy
- CS5 Environmental Literacy

#### CSS2-Learning and Innovation Skills

- CS6 Creativity and Innovation
- CS7 Critical Thinking and Problem Solving
- CS8 Communication and Collaboration

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
- CS14 Social and Cross-Cultural Skills
- CS15 Productivity and Accountability
- CS16 Leadership and Responsibility

## **SUGGESTED REFERENCES**

### Books

- Radcliff, R., & Roark, D. (2003). *Small engines* (3rd ed.). Homewood, IL: American Technical.
- Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.

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Webster, J. (2001). *Outdoor power equipment*. Albany, NY: Delmar.

Webster, J. (2001). *Repairing your outdoor power equipment*. Albany, NY: Delmar

**Course Name:** Small Engine Electrical Systems

**Course Abbreviation:** SET 2613

**Classification:** Career-Technical Core (Certificate and Associates)

**Description:** A course to develop skills and knowledge related to the operating principles of direct current circuits. Includes instruction on basic electrical principles, safety procedures, batteries, conductors, and switches (3 sch: 2-hr lecture, 2-hr lab)

**Prerequisites:** None

<b>Competencies and Suggested Objectives</b>	
1.	Apply basic terms and principles of DC electricity. (DOK2, EEC100, EEC200, EEC300) <ol style="list-style-type: none"> <li>Define electrical terms such as amps, volts, resistance, ohms, and watts. (DOK1)</li> <li>Describe the relationship of magnetism and electricity. (DOK1)</li> <li>Identify and describe the common sources of electricity in small engines. (DOK1)</li> <li>Compare and contrast 12-V direct current to 120-V alternating current. (DOK1)</li> <li>Trace the flow of electricity in a circuit diagram. (DOK1)</li> <li>Identify common components of electrical circuits in small engines. (DOK1)</li> <li>Measure voltage, amperage, and resistance in a circuit using both analog and digital meters. (DOK2)</li> <li>Identify and describe the components of common ignition systems used in small engines including magneto, battery, and electronic systems. (DOK1)</li> <li>Test and service ignition systems, including spark plugs, switches, conductors, and magnetos. (DOK1)</li> </ol>
2.	Inspect and service a battery. (DOK1, EEC300) <ol style="list-style-type: none"> <li>Describe the design and operation of lead-acid storage batteries and their construction. (DOK1)</li> <li>Identify batteries by type, rating, and voltage. (DOK1)</li> <li>Test specific gravity of a battery. (DOK1)</li> <li>Test a battery under load. (DOK1)</li> <li>Clean and service a battery. (DOK1)</li> <li>Charge a battery. (DOK1)</li> <li>Remove and replace a battery. (DOK1)</li> <li>Demonstrate procedure for safe and proper jump starting of an engine. (DOK1)</li> </ol>
3.	Demonstrate basic skills and knowledge related to electrical circuits in small engines. (DOK1, EEC300) <ol style="list-style-type: none"> <li>Trace the flow of current in series, parallel, and series-parallel circuits. (DOK2)</li> <li>Draw circuits using symbols. (DOK1)</li> <li>Identify and describe the use of circuit protection devices including fuses, fusible links, and circuit breakers. (DOK1)</li> <li>Apply circuit testing procedures to detect opens, shorts, and grounds. (DOK1)</li> <li>Repair or replace circuit wiring to including selecting proper wire size and connection device or method. (DOK1)</li> <li>Identify the normal position of switches in a circuit. (DOK1)</li> </ol>

4. Demonstrate basic skills related to starting and charging circuits. <sup>(DOK 1, EEC300)</sup>
  - a. Identify and describe the functions and operation of an electric starting circuit. <sup>(DOK1)</sup>
  - b. Inspect, test, and repair charging circuits as needed. <sup>(DOK3)</sup>
  - c. Identify and describe the functions and operation of an electric charging circuit. <sup>(DOK1)</sup>
  - d. Inspect, test, and repair starting circuits. <sup>(DOK3)</sup>

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EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

### *Related Academic Standards*

- R1 Interpret Graphic Information (forms, maps, reference sources)
  - R2 Words in Context (same and opposite meaning)
  - R3 Recall Information (details, sequence)
  - R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
  - R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
  - M1 Addition of Whole Numbers (no regrouping, regrouping)
  - M2 Subtraction of Whole Numbers (no regrouping, regrouping)
  - M3 Multiplication of Whole Numbers (no regrouping, regrouping)
  - M4 Division of Whole Numbers (no remainder, remainder)
  - M5 Decimals (addition, subtraction, multiplication, division)
  - M6 Fractions (addition, subtraction, multiplication, division)
  - M7 Integers (addition, subtraction, multiplication, division)
  - M8 Percents
  - M9 Algebraic Operations
  - A1 Numeration (ordering, place value, scientific notation)
  - A2 Number Theory (ratio, proportion)
  - A3 Data Interpretation (graph, table, chart, diagram)
  - A4 Pre-Algebra and Algebra (equations, inequality)
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### *21st Century Skills*

### CSS1-21st Century Themes

- CS1 Global Awareness
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- CS3 Civic Literacy
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- CS9 Information Literacy
- CS10 Media Literacy
- CS11 ICT Literacy

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- CS12 Flexibility and Adaptability
- CS13 Initiative and Self-Direction
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- CS15 Productivity and Accountability
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Roth, A. C. (2009). *Small gas engines: Fundamentals, service, troubleshooting, repair, applications* (instructor guide). Tinley Park, IL: Goodheart-Willcox.

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### Journals

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**Course Name:** Special Problem in Small Engine and Equipment Repair Technology

**Course Abbreviation:** SET 281(1-3)

**Classification:** Career-Technical Elective

**Description:** A course designed to provide the student with practical application of skills and knowledge gained in other Small Engine and Equipment Repair Technology courses through the use of a special problem. The instructor works closely with the student to insure that the selection of a project will enhance the student's learning experience. (1-3 sch: 2-6-hr lab)

**Prerequisites:** Consent of instructor

<b>Competencies and Suggested Objectives</b>
1. Develop a written plan that details the activities and projects to be completed. <ol style="list-style-type: none"> <li>a. Use a written plan that details the activities and projects to be completed.</li> <li>b. Perform written occupational objectives in the special problem.</li> </ol>
2. Assess accomplishment of objectives. <ol style="list-style-type: none"> <li>a. Prepare daily written assessments of accomplishment of objectives.</li> <li>b. Present weekly written reports to the instructor of activities performed and objectives accomplished.</li> </ol>
3. Use and follow a set of written guidelines for the special problem. <ol style="list-style-type: none"> <li>a. Develop and follow a set of written guidelines for the special problem.</li> </ol>

## STANDARDS

Specific standards and DOK level for this course will depend upon the nature of the problem under investigation.

## SUGGESTED REFERENCES

Specific references for use in this course will depend upon the nature of the problem under investigation.

**Course Name:** Supervised Work Experience in Small Engine and Equipment Repair Technology

**Course Abbreviation:** SET 291(1-6)

**Classification:** Free Elective

**Description:** A course that is a cooperative program between industry and education designed to integrate the student's technical studies with industrial experience. Variable credit is awarded on the basis of one semester hour per 45 industrial contact hours. (1-6 sch: 3-18-hr externship)

**Prerequisite:** Consent of instructor and completion of at least one semester of advanced coursework in Program Name

<b>Competencies and Suggested Objectives</b>
1. Follow a set of instructor-written guidelines for the supervised work experience program.
2. Apply skills needed to be a viable member of the workforce. <ol style="list-style-type: none"> <li>a. Prepare a description of skills to be developed in the supervised work experience program.</li> <li>b. Practice skills needed to be a viable member of the workforce.</li> </ol>
3. Practice human relationship skills in the supervised work experience program.
4. Practice positive work habits, responsibilities, and ethics.
5. Develop written occupational objectives in the supervised work experience program.
6. Assess performance of occupational skills. <ol style="list-style-type: none"> <li>a. Prepare daily written assessments of work performance as specified in the occupational objectives.</li> <li>b. Present weekly written reports to the instructor of activities performed and objectives accomplished.</li> </ol>

## STANDARDS

Specific standards and DOK level for this course will depend upon the nature of the problem under investigation.

## SUGGESTED REFERENCES

Specific references for use in this course will depend upon the nature of the problem under investigation.

**Course Name:** Small Engine and Equipment Project I

**Course Abbreviation:** SET 2313

**Classification:** Free Elective

**Description:** A course designed for establishment of skills and knowledge for introductory projects related to small engine and equipment (3 sch: 6-hr lab)

**Prerequisite:** Consent of instructor and completion of at least one semester of advanced coursework in Program Name

<b>Competencies and Suggested Objectives</b>
1. Follow a set of instructor-written guidelines for the project.
2. Apply introductory skills needed to be a viable member of the workforce. <ol style="list-style-type: none"> <li>a. Prepare a description of skills to be developed in the supervised work experience program.</li> <li>b. Practice skills needed to be a viable member of the workforce.</li> </ol>
3. Develop written occupational objectives in the project.

## **STANDARDS**

Specific standards and DOK level for this course will depend upon the nature of the problem under investigation.

## **SUGGESTED REFERENCES**

Specific references for use in this course will depend upon the nature of the problem under investigation.

**Course Name:** Small Engine and Equipment Project II

**Course Abbreviation:** SET 2323

**Classification:** Free Elective

**Description:** A course designed for establishment of skills and knowledge for basic projects related to small engine and equipment (3 sch: 6-hr lab)

**Prerequisite:** Consent of instructor and completion of at least one semester of advanced coursework in Program Name

<b>Competencies and Suggested Objectives</b>
1. Follow a set of instructor-written guidelines for the project.
2. Apply basic skills needed to be a viable member of the workforce. <ol style="list-style-type: none"> <li>a. Prepare a description of skills to be developed in the supervised work experience program.</li> <li>b. Practice skills needed to be a viable member of the workforce.</li> </ol>
3. Develop written occupational objectives in the project.

## **STANDARDS**

Specific standards and DOK level of this course will depend upon the nature of the problem under investigation.

## **SUGGESTED REFERENCES**

Specific references for use in this course will depend upon the nature of the problem under investigation.

**Course Name:** Small Engine and Equipment Project III

**Course Abbreviation:** SET 2333

**Classification:** Free Elective

**Description:** A course designed for establishment of skills and knowledge for intermediate projects related to small engine and equipment (3 sch: 6-hr lab)

**Prerequisite:** Consent of instructor and completion of at least one semester of advanced coursework in Program Name

<b>Competencies and Suggested Objectives</b>
1. Follow a set of instructor-written guidelines for the project.
2. Apply intermediate skills needed to be a viable member of the workforce. <ol style="list-style-type: none"> <li>a. Prepare a description of skills to be developed in the supervised work experience program.</li> <li>b. Practice skills needed to be a viable member of the workforce.</li> </ol>
3. Develop written occupational objectives in the project.

## **STANDARDS**

Specific standards and DOK level for this course will depend upon the nature of the problem under investigation.

## **SUGGESTED REFERENCES**

Specific references for use in this course will depend upon the nature of the problem under investigation.

**Course Name:** Small Engine and Equipment Project IV

**Course Abbreviation:** SET 2343

**Classification:** Free Elective

**Description:** A course designed for establishment of skills and knowledge for advanced projects related to small engine and equipment. (3 sch: 6-hr lab)

**Prerequisite:** Consent of instructor and completion of at least one semester of advanced coursework in Program Name

<b>Competencies and Suggested Objectives</b>
1. Follow a set of instructor-written guidelines for the project.
2. Apply advanced skills needed to be a viable member of the workforce. <ol style="list-style-type: none"> <li>a. Prepare a description of skills to be developed in the supervised work experience program.</li> <li>b. Practice skills needed to be a viable member of the workforce.</li> </ol>
3. Develop written occupational objectives in the project.

## **STANDARDS**

Specific standards and DOK level for this course will depend upon the nature of the problem under investigation.

## **SUGGESTED REFERENCES**

Specific references for use in this course will depend upon the nature of the problem under investigation.

**Course Name:** Work-Based Learning I, II, III, IV, V, and VI

**Course Abbreviation:** WBL 191(1-3), WBL 192(1-3), WBL 193(1-3), WBL 291(1-3), WBL 292(1-3), and WBL 293(1-3)

**Classification:** Free Elective

**Description:** A structured work-site learning experience in which the student, program area teacher, Work-Based Learning Coordinator, and work-site supervisor/mentor develop and implement an educational training agreement. Designed to integrate the student's academic and technical skills into a work environment. May include regular meetings and seminars with school personnel and employers for supplemental instruction and progress reviews (1-3 sch: 3-9-hr externship)

**Prerequisite:** Concurrent enrollment in career-technical program area courses

<b>Competencies and Suggested Objectives</b>	
1.	Apply technical skills and related academic knowledge needed to be a viable member of the workforce. <ol style="list-style-type: none"> <li>a. Demonstrate technical skills necessary to complete job requirements.</li> <li>b. Demonstrate academic skills necessary to complete job requirements.</li> <li>c. Perform tasks detailed in an educational training agreement at the work setting.</li> </ol>
2.	Apply general workplace skills to include positive work habits necessary for successful employment. <ol style="list-style-type: none"> <li>a. Demonstrate appropriate human relationship skills in the work setting to include conflict resolution, team participation, leadership, negotiation, and customer/client service.</li> <li>b. Utilize time, materials, and resource management skills.</li> <li>c. Use critical-thinking skills such as problem solving, decision making, and reasoning.</li> <li>d. Acquire, evaluate, organize, maintain, interpret, and communicate information.</li> </ol>

## STANDARDS

Specific standards and DOK level for this course will depend upon the nature of the problem under investigation.

## SUGGESTED REFERENCES

Specific references for this course will depend upon the nature of the problem under investigation.

## Recommended Tools and Equipment

### CAPITALIZED ITEMS

1. Basic student tool set (1 per student)
  - ¼-in. drive socket set standard and deep 3/16 in. to 9/16 in. and metric (5 mm to 15 mm)
  - 1/4-in. drive ratchet, universal joint, and extensions
  - 3/8-in. drive socket set standard 5/16 in. to 7/8 in. and metric (10 mm to 19 mm)
  - 3/8-in. ratchet with universal joint and extensions
  - 1/2-in. socket set standard and deep 7/16 in. to 1 ¼ in. and metric (10 mm to 24 mm)
  - ¼-in., 3/8-in., and 1/2-in. pull handles
  - 1/4-in., 3/8-in., and 1/2-in. torque wrenches
  - Combination wrench set (1/4 in. to 1 ¼ in. and 10 mm to 24 mm)
  - Punch and chisel set
  - Tongue and groove, regular, needle nose, and cutting pliers
  - Open end adjustable wrenches (2)
  - Allen wrenches 1.5 mm to 10 mm and 0.028 in. to 3/8 in.
  - Screwdriver set - Standard and Phillips
  - Torx driver set
  - 16-oz ball-peen hammer
  - 1.5-oz brass hammer
  - Soft face hammer
  - 1/2-in. air impact driver
  - 1/2-in. Impact socket set socket set standard and deep 7/16 in. to 1 ¼ in. and metric (10 mm to 24 mm)
  - 3/8-in. cordless electric impact driver
  - 3/8-in. impact socket set standard 5/16 in. to 7/8 in. and metric (10 mm to 19 mm)
  - Convertible snap ring pliers
  - Digital volt-ohm meter
  - Circuit continuity tester
  - Gasket scrapper
  - Magnetic pickup tool
  - Locking jaw pliers (ViseGrip)
  - Tool chest or cabinet
  - Flashlight
  - Mechanics gloves
  - Rubber safety gloves
  - Battery terminal cleaner
  - Battery terminal pliers
  - Safety glasses
  - Hearing protection
2. Air compressor with regulator and hoses (1)
3. Mechanics benches with vise (1 per 2 students)
4. Oxyfuel cutting torch set
5. Hydraulic floor hoist

6. Hydraulic press with adapters
7. Parts cleaning tank with gloves
8. Hydraulic pressure testing kit
9. SMAW welder (2)
10. GMAW welder (2)
11. Pressure washer
12. Hydraulic or pneumatic lift table (2)
13. String trimmer (2)
14. Chain saw (2)
15. Reel mower
16. Reel and Bed knife grinder with accessories and attachments (1)
17. Rotary mower (residential) (2)
18. Zero turn hydrostatic mower
19. Edger (2)
20. Utility vehicle (Gator)
21. Commercial 20-in. rotary mower
22. Gasoline pole pruner
23. Compact diesel engine
24. Stationary two-stroke engines (4)
25. Stationary four-stroke engines (4)
26. Valve and seat grinder
27. Computer with monitor, printer, and Internet access (1 per 2 students)
28. Flammable material cabinet
29. Engine dynamometer (0-50 hp)
30. Tire machine

#### NON-CAPITALIZED ITEMS

1. Bench grinder (2)
2. Drill (1/2-in. variable speed reversible) with drill bits
3. Drill (3/8-in. variable speed reversible) with drill bits
4. Extension cords (1 per 2 students)
5. Hoists (2)
6. Master puller set
7. Oil filter wrench
8. Remote starter switch
9. Soldering gun
10. Tap and die set (standard and metric)
11. Thread repair kit (standard and metric)
12. Tire pressure gauge (4)
13. Trouble/work light (4)
14. Hose clamp pliers (4)
15. Impact screwdriver set (1)
16. Waste oil receptacle
17. Hack saw (4)
18. Battery charger/starter (2)
19. Battery load tester (2)

20. Battery hydrometer
21. 6-in. steel ruler (4)
22. Cylinder bore gauge (2)
23. Depth micrometer (2)
24. Inside micrometer set (2)
25. Outside micrometer set (2)
26. Feeler gauge set (4)
27. Dial calipers (metric and standard) (2)
28. Dial indicator with base (2)
29. Engine tachometer (2)
30. Multimeter (4)
31. Belt tension gauge
32. Piston ring expander (2)
33. Piston groove cleaning tool (2)
34. Antifreeze coolant tester (4)
35. Carburetor nozzle tool
36. Ridge reamer
37. Radiator and pressure cap tester
38. Cylinder hone
39. Valve spring compressor
40. Ring compressor
41. Strap wrench
42. Oil filter wrenches (assorted sizes)
43. Ignition wrenches
44. Spanner wrenches
45. Flywheel puller
46. Hand held side grinder (2)
47. Commercial blade grinder
48. Commercial chain saw sharpener
49. Electrical terminal connecting tool
50. Crankcase pressure tester
51. Spark tester
52. Timing light
53. Oil disposal container
54. Mechanics creeper (4)

(NOTE: Additional manufacturer specific tools will be required to work on specific engines.)

#### RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Microcomputer integrated software package (word processing, spreadsheet, and database)
2. LCD video projector
3. VCR/DVD player
4. TV monitor

5. ELMO
6. Bore scope
7. Digital camera

## Appendix A: Proposed Standards for Small Engine and Equipment Repair Technology<sup>1</sup>

The following standards were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

EEC100	Two and Four Stroke Gasoline Engines, Systems and Components
EEC200	Drivelines/Hydraulics/Hydrostatic Systems and Components
EEC300	Electrical Systems and Components

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<sup>1</sup> Industry standards for Small Engine Repair courses were adapted from the publication *Program Assessment Manual: Power Equipment Technology* as published by the Equipment and Engine Training Council. For more information, see the Council's Web site at [www.eetc.org](http://www.eetc.org).

## Appendix B: Related Academic Standards<sup>2</sup>

### Reading

- R1 Interpret Graphic Information (forms, maps, reference sources)
- R2 Words in Context (same and opposite meaning)
- R3 Recall Information (details, sequence)
- R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
- R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

### Mathematics Computation

- M1 Addition of Whole Numbers (no regrouping, regrouping)
- M2 Subtraction of Whole Numbers (no regrouping, regrouping)
- M3 Multiplication of Whole Numbers (no regrouping, regrouping)
- M4 Division of Whole Numbers (no remainder, remainder)
- M5 Decimals (addition, subtraction, multiplication, division)
- M6 Fractions (addition, subtraction, multiplication, division)
- M7 Integers (addition, subtraction, multiplication, division)
- M8 Percents
- M9 Algebraic Operations

### Applied Mathematics

- A1 Numeration (ordering, place value, scientific notation)
- A2 Number Theory (ratio, proportion)
- A3 Data Interpretation (graph, table, chart, diagram)
- A4 Pre-Algebra and Algebra (equations, inequality)
- A5 Measurement (money, time, temperature, length, area, volume)
- A6 Geometry (angles, Pythagorean theory)
- A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
- A8 Estimation (rounding, estimation)

### Language

- L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
- L2 Sentence Formation (fragments, run-on, clarity)
- L3 Paragraph Development (topic sentence, supporting sentence, sequence)
- L4 Capitalization (proper noun, titles)
- L5 Punctuation (comma, semicolon)
- L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

### Spelling

- S1 Vowel (short, long)
- S2 Consonant (variant spelling, silent letter)
- S3 Structural Unit (root, suffix)

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<sup>2</sup> CTB/McGraw-Hill LLC. (1994). *Tests of adult basic education, forms 7 and 8*. Monterey, CA: Author. Reproduced with permission of CTB/McGraw-Hill LLC. TABE is a registered trademark of The McGraw-Hill Companies, Inc. Copyright © 1994 by CTB/McGraw-Hill LLC. Reproduction of this material is permitted for educational purposes only.

## Appendix C: 21st Century Skills<sup>3</sup>

### CSS1-21st Century Themes

#### CS1 Global Awareness

1. Using 21st century skills to understand and address global issues
2. Learning from and working collaboratively with individuals representing diverse cultures, religions, and lifestyles in a spirit of mutual respect and open dialogue in personal, work, and community contexts
3. Understanding other nations and cultures, including the use of non-English languages

#### CS2 Financial, Economic, Business, and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

#### CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national and global levels
3. Understanding the local and global implications of civic decisions

#### CS4 Health Literacy

1. Obtaining, interpreting, and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance, and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

#### CS5 Environmental Literacy

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water and ecosystems.
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.).
3. Investigate and analyze environmental issues, and make accurate conclusions about effective solutions.
4. Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues).

### CSS2-Learning and Innovation Skills

#### CS6 Creativity and Innovation

1. Think Creatively
2. Work Creatively with Others

<sup>3</sup> *21st century skills*. (n.d.). Washington, DC: Partnership for 21st Century Skills.

- 3. Implement Innovations
- CS7 Critical Thinking and Problem Solving
  - 1. Reason Effectively
  - 2. Use Systems Thinking
  - 3. Make Judgments and Decisions
  - 4. Solve Problems
- CS8 Communication and Collaboration
  - 1. Communicate Clearly
  - 2. Collaborate with Others

#### CSS3-Information, Media and Technology Skills

- CS9 Information Literacy
  - 1. Access and Evaluate Information
  - 2. Use and Manage Information
- CS10 Media Literacy
  - 1. Analyze Media
  - 2. Create Media Products
- CS11 ICT Literacy
  - 1. Apply Technology Effectively

#### CSS4-Life and Career Skills

- CS12 Flexibility and Adaptability
  - 1. Adapt to Change
  - 2. Be Flexible
- CS13 Initiative and Self-Direction
  - 1. Manage Goals and Time
  - 2. Work Independently
  - 3. Be Self-directed Learners
- CS14 Social and Cross-Cultural Skills
  - 1. Interact Effectively with Others
  - 2. Work Effectively in Diverse Teams
- CS15 Productivity and Accountability
  - 1. Manage Projects
  - 2. Produce Results
- CS16 Leadership and Responsibility
  - 1. Guide and Lead Others
  - 2. Be Responsible to Others