

2 & 4 CYCLE ENGINE II

2 & 4 CYCLE ENGINE II is a course that prepares students for entry-level positions or advanced training in 2 & 4 cycle engines. Course content focuses on 2 & 4 cycle engines used on motorcycles, all-terrain vehicles (ATV), jet skis, outboard motors, garden equipment, and outdoor power equipment and vehicles. Students will perform inspections, tests, and measurements for diagnosis and perform needed repairs. Education and experience simulate small engine industry operations through the use of training aids and modules and offer school-based and work-based learning opportunities. Provides training for a 2 & 4 cycle engine certification from Equipment and Engine Training Council (EETC).

It is strongly recommended that administration and guidance follow the scope and sequence and course recommendations as listed.

Recommended:	Transportation Core, 2 & 4 Cycle Engines I
Recommended Credit:	1
Recommended Grade Level(s):	11th
Number of Competencies:	56

2 & 4 CYCLE ENGINE II

STANDARDS

- 1.0** Students will perform safety examinations and maintain safety records.
- 2.0** Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.
- 3.0** Students will integrate reading, writing, math, and science skills and understand the impact of academic achievement in the work place.
- 4.0** Students will define, test, diagnosis, and repair 2 & 4 cycle engine ignition systems.
- 5.0** Students will test, diagnose, service, and repair charging and electrical systems as related to 2 & 4 cycle engines.
- 6.0** Students will test, diagnose, service, and repair starting systems as related to 2 & 4 cycle engines.
- 7.0** Students will test, diagnose, service, and repair fuel delivery systems as related 2 & 4 cycle engines.

2 & 4 CYCLE ENGINE II

STANDARD 1.0

Students will perform safety examinations and maintain safety records.

LEARNING EXPECTATIONS

The student will:

- 1.1 Demonstrate a positive attitude regarding safety practices and issues.
- 1.2 Use and inspect personal protective equipment.
- 1.3 Inspect, maintain, and employ safe operating procedures with tools and equipment, such as hand and power tools, ladders, scaffolding, and lifting equipment.
- 1.4 Demonstrate continuous awareness of potential hazards to self and others and respond appropriately.
- 1.5 Assume responsibilities under HazCom (Hazard Communication) regulations.
- 1.6 Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies to protect coworkers and bystanders from hazards.
- 1.7 Adhere to responsibilities, regulations, and Occupational Safety & Health Administration (OSHA) policies regarding reporting of accidents and observed hazards, and regarding emergency response procedures.
- 1.8 Demonstrate appropriate related safety procedures.
- 1.9 Pass with 100 % accuracy a written examination relating to safety issues
- 1.10 Pass with 100% accuracy a performance examination relating to safety.
- 1.11 Maintain a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 1.1A Is attentive during safety discussions.
- 1.1B Actively seeks information about safe procedures.
- 1.1C Responds positively to instruction, advice, and correction regarding safety issues.
- 1.1D Does not deliberately create or increase hazards, such as by horseplay, practical jokes, or creating distractions.
- 1.1E Reports to school or work physically ready to perform to professional standards, such as rested, or not impaired by medications, drugs, alcohol, etc.
- 1.2 Selects, inspects, and uses the correct personal protective equipment for the assigned task.
- 1.3A Inspects power tools for intact guards, shields, insulation, and other protective devices.
- 1.3B Inspects extension cords for the presence of a functional ground connection, prior to use.
- 1.3C Operates and maintains tools in accordance with manufacturer's instructions and as required by regulation or company policy.
- 1.4A Is observant of personnel and activities in the vicinity of the work area.
- 1.4B Warns nearby personnel, prior to starting potentially hazardous actions.
- 1.5A When asked to use a new hazardous material, retrieves MSDSs (material safety data sheets), and identifies the health hazards associated with the new material.

- 1.5B** Reports hazards found on the job site to the supervisor.
- 1.6A** Erects shields, barriers, and signage to protect coworkers and bystanders prior to starting potentially hazardous tasks.
- 1.6B** Provides and activates adequate ventilation equipment as required by the task.
- 1.7A** Reports all injuries to self to the immediate supervisor.
- 1.7B** Reports observed unguarded hazards to their immediate supervisor.
- 1.8A** Complies with personal assignments regarding emergency assignments.
- 1.9A** Passes with 100% accuracy a written examination relating specifically to content area.
- 1.10A** Passes with 100% accuracy a performance examination relating specifically to welding tools, equipment and supplies.
- 1.11A** Maintains a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.

SAMPLE PERFORMANCE TASKS

These are sample projects of the type and scale recommended to address one or more of the learning expectations for this standard. Other projects can be used at the instructor's discretion.

- Conduct a practice drill simulating a hazardous solvent spill in which an emergency action plan is to be implemented.
- Instruct a visitor to obviously approach the vicinity of a student conducting a hazardous activity and note the level of awareness demonstrated by the student.
- For a project requiring the use of ladders and/or scaffolding, note the proper placement and securing procedures followed by students.

INTEGRATION LINKAGES

Language Arts, Mathematics, Technical Algebra, Technical Geometry, Algebra, Geometry English IV: Communication for Life, SkillsUSA Technical Championships, American Welding Society (AWS), Guide for Training and Qualification of Entry Level Welder, National Center for Construction Education Research (NCCER), Secretary's Commission on Achieving Necessary Skills (SCANS), Professional Development Program, SkillsUSA

2 & 4 CYCLE ENGINE II

STANDARD 2.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:

- 2.1** Cultivate positive leadership skills.
- 2.2** Participate in the student organization directly related to their program of study as an integral part of classroom instruction.
- 2.3** Assess situations, apply problem-solving techniques and decision-making skills within the school, community, and workplace.
- 2.4** Participate as a team member in a learning environment.
- 2.5** Respect the opinions, customs, and individual differences of others.
- 2.6** Build personal career development by identifying career interests, strengths, and opportunities.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 2.1A** Demonstrates character and leadership using creative-and critical-thinking skills.
- 2.1B** Uses creative thought process by “thinking outside the box.”
- 2.2A** Relates the creed, purposes, motto, and emblem of their student organization, directly related to personal and professional development.
- 2.2B** Plans and conducts meetings and other business according to accepted rules of parliamentary procedure.
- 2.3A** Makes decisions and assumes responsibilities.
- 2.3B** Analyzes a situation and uses the Professional Development Program or career technical student organization materials directly related to the student’s program of study to resolve it.
- 2.3C** Understands the importance of learning new information for both current and future problem solving and decision making.
- 2.4A** Organizes committees and participates in functions.
- 2.4B** Cooperates with peers to select and organize a community service project.
- 2.5A** Researches different customs and individual differences of others.
- 2.5B** Interacts respectfully with individuals of different cultures, gender, and backgrounds.
- 2.5C** Resolves conflicts and differences to maintain a smooth workflow and classroom environment.
- 2.6A** Creates personal career development by identifying career interests, strengths, and opportunities.
- 2.6B** Identifies opportunities for career development and certification requirements.
- 2.6C** Plans personal educational paths based on available courses and current career goals.
- 2.6D** Creates a resumé that reflects student’s skills, abilities, and interests.

SAMPLE PERFORMANCE TASKS

- Create a leadership inventory and use it to conduct a personal assessment.
- Participate in various career technical student organizations' programs and/or competitive events.
- Implement an annual program of work.
- Prepare a meeting agenda for a specific career technical student organization monthly meeting.
- Attend a professional organization meeting.
- Develop a program of study within their career opportunities.
- Participate in the American Spirit Award competition with SkillsUSA.
- Complete *Professional Development Program Level I and Level II*, SkillsUSA.

INTEGRATION LINKAGES

SkillsUSA, *Professional Development Program*; SkillsUSA; Communications and Writing Skills; Teambuilding Skills; Research; Language Arts; Sociology; Psychology; Math; Technical Math; English IV: Communication for Life; Social Studies; Problem Solving; Interpersonal Skills; Employability Skills; Critical-Thinking Skills; Secretary's Commission on Achieving Necessary Skills (SCANS); Chamber of Commerce; Colleges; Universities; Technology Centers; Secretary's Commission on Achieving Necessary Skills (SCANS)

2 & 4 CYCLE ENGINE II

STANDARD 3.0

Students will integrate reading, writing, math, and science skills and understand the impact of academic achievement in the work place.

LEARNING EXPECTATIONS

The student will:

- 3.1 Assume responsibility for accomplishing classroom assignments and workplace goals within accepted time frames.
- 3.2 Develop advanced study skills.
- 3.3 Demonstrate and use written and verbal communication skills.
- 3.4 Read and understand technical documents such as regulations, manuals, reports, forms, graphs, charts, and tables.
- 3.5 Apply the foundations of mathematical principles such as algebra, geometry, and advanced math to solve problems.
- 3.6 Apply basic scientific principles and methods to solve problems and complete tasks.
- 3.7 Understand computer operations and related applications to input, store, retrieve, and output information as it relates to the course.
- 3.8 Research, recognize, and understand the interactions of the environment and *green* issues as they relate to the course work and to a global economy.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

- 3.1A Uses appropriate time management to achieve goals.
- 3.1B Arrives at school on time each day.
- 3.1C Completes assignments and meets deadlines.
- 3.2A Assesses current personal study skills.
- 3.2B Demonstrates advanced note-taking ability.
- 3.2C Formulates appropriate study strategies for given tasks.
- 3.3A Communicates ideas, information, and messages in a logical manner.
- 3.3B Fills out forms, reports, logs, and documents to comply with class and project requirements.
- 3.4A Reads and understands technical documents and uses industry jargon, acronyms, and terminology appropriately.
- 3.4B Recognizes the meaning of specialized words or phrases unique to the career and industry.
- 3.5A Utilizes computation in adding, subtracting, multiplying, and dividing of whole numbers, fractions, decimals, and percents.
- 3.5B Chooses the right mathematical method or formula to solve a problem.
- 3.5C Performs math operations accurately to complete classroom and lab tasks.
- 3.6A Understands scientific principles critical to the course.
- 3.6B Applies scientific principles and technology to solve problems and complete tasks.
- 3.6C Has knowledge of the scientific method (e.g., identifies the problem, collects information, forms opinions, and draws conclusions).
- 3.7A Uses basic computer hardware (e.g., PCs, printers) and software to perform tasks

as required for the course work.

- 3.7B** Understands capabilities of computers and common computer terminology (e.g., program, operating system).
- 3.7C** Applies the appropriate technical solution to complete tasks.
- 3.7D** Inputs data and information accurately for the course requirements.
- 3.8A** Researches and recognizes *green* trends in career area and industry.
- 3.8B** Examines current environmentally-friendly trends.
- 3.8C** Applies sustainability practices by understanding processes that are non-polluting, conserving of energy and natural resources, and economically efficient.

SAMPLE PERFORMANCE TASKS

- Examine and compile different learning styles for portfolios.
- Create calendars containing all activities and obligations for one month. Discusses how to handle conflicting or competing obligations then complete daily and weekly plans showing tasks, priorities, and scheduling.
- Complete self-assessments of study habits.
- Compute precise and exact measurements.
- Explore study strategies for different subjects and tasks then analyze two homework assignments and select the best strategies for completing them.
- Create “life maps” showing necessary steps or “landmarks” along the path to personal, financial, educational, and career goals.
- Take notes during counselor classroom visits and work in small groups to create flow charts of the path options.
- List attitudes that lead to success then rate individually in these areas. Work together to suggest strategies for overcoming the weaknesses identified own and partners’ self-assessments then share with the class the strategies developed.
- Research the Internet and other technology to collect and analyze data concerning climate change.
- Keep a data file of alternative energy sources and the sources’ impact on the environment.
- Develop a recycling project at home or for the school environment.

INTEGRATION LINKAGES

SkillsUSA, *Professional Development Program*; SkillsUSA; Communications and Writing Skills; Teambuilding Skills; Research; Language Arts; Sociology; Psychology; Math; Technical Math; English IV: Communication for Life; Social Studies; Problem Solving; Interpersonal Skills; Employability Skills; Critical-Thinking Skills; Secretary’s Commission on Achieving Necessary Skills (SCANS); Chamber of Commerce; Colleges; Universities; Technology Centers; Secretary’s Commission on Achieving Necessary Skills (SCANS)

2 & 4 CYCLE ENGINE II

STANDARD 4.0

Students will define, test, diagnose, and repair 2 & 4 cycle engine ignition systems.

LEARNING EXPECTATIONS

The student will:

- 4.1 Describe the purpose, nomenclature, and function of an ignition system.
- 4.2 Identify the components and function of an electronic ignition system
- 4.3 Identify the components and function of magneto ignition system.
- 4.4 Identify the components of a battery ignition system.
- 4.5 Explain the function of a coil in the ignition system.
- 4.6 Test and repair spark plug wires and cables.
- 4.7 Diagnose, test, and repair distributor cap and rotor.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 4.1A Identifies and describes the components of a 2 & 4 cycle engine ignition system.
- 4.1B Draws an electrical schematic of an ignition system.
- 4.2A Identifies the components and functions of an electronic ignition system.
- 4.2B Explains the differences of a distributor-type ignition system and a distributorless system.
- 4.3 Identifies the components and function of a magneto ignition system.
- 4.4 Identifies the components of a battery system.
- 4.5 Describes the different parts of an ignition coil and explains its function.
- 4.6 Tests and repairs ignition cables using a DMM and proper tools.
- 4.7 Diagnoses, tests, and determines repair or replacement of ignition distributor cap and rotor.

SAMPLE PERFORMANCE TASKS

- Make a list of ignition system manufacturers.
- Make a list of the different types of ignition systems.
- Make a list of the components used in 2 & 4 cycle engine ignition systems.
- Measure voltage at various points in the ignition system using a DMM and list them.
- Measure resistance in the primary and secondary circuits of the ignition coil.
- Remove and replace ignition cables and distributor caps as needed.

INTEGRATION LINKAGES

Math, Science, Communication Skills, Teamwork Skills, Reading Skills, Leadership Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), National Institute for Automotive Service Excellence, National Automotive Technician Education Foundation (NATEF), Occupational Safety and Health Administration (OSHA), Environmental Protection Agency (EPA), SkillsUSA, CDX eTextbook, Equipment and Engine Training Council, Outdoor Power Equipment.

2 & 4 CYCLE ENGINE II

STANDARD 5.0

Students will test, diagnose, service, and repair charging and electrical systems as related to 2 & 4 cycle engines.

LEARNING EXPECTATIONS

The student will:

- 5.1** Illustrate the application of Ohm's law to charging and electrical systems related to 2 & 4 cycle engines.
- 5.2** Describe series and parallel circuits.
- 5.3** Identify electrical wire sizes and color symbols.
- 5.4** Demonstrate ability to read electrical schematics, wiring diagrams, and electrical symbols.
- 5.5** Demonstrate ability to properly setup and read a Digital Multi Meter (DMM).
- 5.6** Perform resistance check, voltage check, and amperage check on an electrical circuit using a DMM.
- 5.7** Inspect, test, and replace fusible links, fuses, and circuit breakers.
- 5.8** Explain storage battery theory, construction, and disposal in accordance with EPA, local, and state ordinances.
- 5.9** Remove, clean, and replace battery, perform specific gravity test, and determine battery state of charge using a battery tester.
- 5.10** Check alternator/generator output using battery tester or DMM.
- 5.11** Remove/replace alternators/generators on 2 & 4cycle engines.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 5.1A** Demonstrates understanding of Ohm's Law and its formula.
- 5.1B** Correctly defines voltage, resistance, and amperage and how they relate to each other.
- 5.2A** Identifies all the elements that make up a series and a parallel circuit.
- 5.2B** Correctly draws a simple series circuit and a parallel circuit.
- 5.3A** Makes a chart of electrical wire sizes and colors used in 2 & 4 cycle wiring harnesses.
- 5.3B** Properly uses a soldering iron and connectors to repair electrical wires.
- 5.4** Demonstrates ability to read electrical schematics, wiring diagrams, and electrical symbols.
- 5.5** Demonstrates ability to properly setup and read a Digital Multi Meter (DMM).
- 5.6** Performs resistance check, voltage check, and amperage check on an electrical circuit using a DMM.
- 5.7** Inspects, tests, and replaces fusible links, fuses, and circuit breakers.
- 5.8** Explains storage battery theory, construction, and disposal in accordance with EPA, local, and state ordinances.
- 5.9** Removes, cleans, and replaces battery, perform specific gravity test, and determines battery state of charge using a battery tester.
- 5.10** Checks alternator/generator output using battery tester or DMM and determines necessary repairs.
- 5.11** Removes/replaces alternators/generators on 2 & 4cycle engines.

SAMPLE PERFORMANCE TASKS

- Understand what voltage, resistance, and ampere are and how to measure them using a DMM.
- Understand how resistance affects an electrical circuit using Ohm's Law.
- Demonstrate ability to read wiring diagrams and symbols.
- Check fusible links, fuses, and circuit breakers using a test light and a DMM.
- Perform a voltage drop test on an electrical circuit.
- Explain what the CCA rating on a battery is.
- Use a variety of battery testers to test batteries, alternators, or generators.
- Remove and replace batteries, starters, and generators.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Science, Electronics, Chemistry, Physics, Applied Communications, Technical Writing, Problem-Solving and Critical Thinking Skills, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environment Protection Agency (EPA), SkillsUSA, Interpersonal Skills, Employability Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), CDX eTextbook, Equipment and Engine Training Council (EETC), Outdoor Power Equipment (OPEESA).

2 & 4 CYCLE ENGINE II

STANDARD 6.0

Students will test, diagnose, service, and repair fuel delivery systems as related to 2 & 4 cycle engines.

LEARNING EXPECTATIONS

The student will:

- 6.1** Identify types of carburetors, fuel injectors, and fuel pump designs.
- 6.2** Describe nomenclature and function of vacuum-feed, diaphragm, float, rotary, and slide valve carburetors.
- 6.3** Identify and describe the idle circuit and the main circuit.
- 6.4** Disassemble, clean, and reassemble carburetors.
- 6.5** Install a repair kit in a carburetor and inspect internal parts for wear or damage.
- 6.6** Adjust choke linkage, float level, and engine speed.
- 6.7** Describe fuel injector operation and nomenclature.
- 6.8** Remove and repair fuel lines, hoses, filters, and fuel tanks.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 6.1** Identifies and describes various carburetors, fuel injectors, and fuel pumps.
- 6.2** Lists the nomenclature and explains the function of vacuum-feed, diaphragm, float, rotary, and slide carburetors.
- 6.3** Identifies and describes the idle circuit and the main circuit of a single barrel carburetor.
- 6.4** Disassembles, cleans, and reassembles a carburetor.
- 6.5** Installs a repair kit in a carburetor and inspects internal parts for wear or damage.
- 6.6** Adjusts choke linkage, float level, and engine speed.
- 6.7** Describes fuel injector operation and nomenclature.
- 6.8** Removes and repairs fuel lines, hoses, fuel filters, and fuel tanks.

SAMPLE PERFORMANCE TASKS

- Uses textbook, Internet, magazines, parts catalogs to make a list of various carburetors, fuel injectors, and fuel pumps.
- List the different parts and functions of a carburetor.
- Describe the venture principle used in carburetors.
- Disassembles and rebuilds carburetors.
- Describe the parts of a fuel injector and properly perform resistance check with ohm meter.
- Repair and pressure test fuel line.
- Adjust idle speed on a carbureted engine and a fuel injected engine.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Science, Electronics, Chemistry, Physics, Applied Communications, Technical Writing, Problem-Solving and Critical Thinking Skills, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environment Protection Agency (EPA), SkillsUSA, Interpersonal Skills, Employability Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), CDX eTextbook, Equipment and Engine Training Council (EETC), Outdoor Power Equipment (OPEESA).

2 & 4 CYCLE ENGINE II

STANDARD 7.0

Students will test, diagnose, service, and repair starting systems as related to 2 & 4 cycle engines.

LEARNING EXPECTATIONS

The student will:

- 7.1 Describe engine starting systems, nomenclature, and function.
- 7.2 Identify the components of a recoil starting system and describe the function of each.
- 7.3 Identify the components of a DC/AC electric starting system and describe the function of each.
- 7.4 Describe the operation of a break-away clutch used on AC and DC electric starter motors.
- 7.5 Demonstrate how to use a battery tester/DMM to measure amperage draw in DC starter motors.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 7.1 Describes engine mechanical and electric starting systems, nomenclature, and function.
- 7.2 Identifies the components of a recoil starting system and describes the function of each.
- 7.3 Identifies and lists the components of a DC/AC electric starting systems and describes the function of each.
- 7.4 Describes the operation of a break-away (over-run) clutch used on AC and DC electric starter motors.
- 7.5 Demonstrates using a battery tester or DMM to measure amperage draw in DC starter motors.

SAMPLE PERFORMANCE TASKS

- Make a list of starting systems used by 2 & 4 cycle engines.
- Disassemble a mechanical recoil starter and an electric starter and make a list of components.
- Lookup test procedures for testing starter relays, solenoids, and armatures.
- Test amperage draw on an electric starter system using a battery tester or DMM.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Science, Electronics, Chemistry, Physics, Applied Communications, Technical Writing, Problem-Solving and Critical Thinking Skills, Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environment Protection Agency (EPA), SkillsUSA, Interpersonal Skills, Employability Skills, Secretary's Commission on Achieving Necessary Skills (SCANS), CDX eTextbook, Equipment and Engine Training Council (EETC), Outdoor Power Equipment (OPEESA).

2 & 4 CYCLE ENGINE II

SUGGESTED RESOURCES

- Briggs and Stratton Power Equipment
- Harley Davidson Motorcycle Company
- National Automotive Technicians Education Foundation (NATEF) www.natef.org
- A8 Engine Performance, CD-ROM, Interactive Computer Based Training, DVP/CDX, 1-888-873-2239
- Multistate Academic and Vocational Curriculum Consortium, Inc. (MAVCC), *Power Product Equipment Technicians: Outboard-Engine Systems and Service*
- Outboard Engine Accessories Parts Catalogs
- Outboard Marine Corporation (OMC) Service Manuals
- *Boating Magazine*, New York, New York, 10019, 212-767-5585
- *Motor Boating and Sailing* magazine, New York, New York 10019, 212-649-4099
- American Power Boat Association (APBA)
- *Prope*
- Honda Motor Company
- Yamaha
- SkillsUSA, www.skillsusa.org
- Equipment and Engine Training Council
- Outdoor Power Equipment