

2 & 4 CYCLE ENGINES III

2 & 4 CYCLE ENGINE III 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.

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| Recommended: | Transportation Core, 2 & 4 Cycle Engine I, 2 & 4 Cycle Engine II |
| Recommended Credit: | 2 |
| Recommended Grade Level(s): | 12th |
| Number of Competencies: | 44 |

2 & 4 CYCLE ENGINE III

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 workplace.
- 4.0** Students will perform engine diagnostics on 2 & 4 cycle engines.
- 5.0** Students will complete a 2 cycle and a 4 cycle engine overhaul.
- 6.0** Students will develop a business plan/model for starting a business.

2 & 4 CYCLE ENGINE III

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 III

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 III

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 III

STANDARD 4.0

Students will perform engine diagnostics on 2 & 4 cycle engines.

LEARNING EXPECTATIONS

The student will:

- 4.1** Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emission problems on vehicles with carbureted-type fuel systems; determine necessary action.
- 4.2** Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emission problems on vehicles with injection-type fuel systems; determine necessary action.
- 4.3** Diagnose ignition electrical problems on points/breaker type and electronic/solid state type ignition systems.
- 4.4** Diagnose mechanical failures on 2 & 4 cycle engines.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS ME

- 4.1A** Diagnoses hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emission problems on vehicles with carbureted-type fuel systems; determines necessary action.
- 4.1B** Uses proper diagnostic tools such as DMM, pressure gauges, compression tests, scan tools, service manuals, and wiring diagrams to determine necessary action.
- 4.2** Diagnoses hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emission problems on vehicles with injection-type fuel systems; determines necessary action.
- 4.3A** Diagnoses ignition electrical problems on points/breaker type and electronic type ignition systems.
- 4.3B** Diagnoses magneto type ignition system.
- 4.3C** Diagnoses ignition coils using DMM.
- 4.4A** Diagnoses mechanical failures on 2 & 4 cycle engines.
- 4.4B** Disassembles a 2 cycle and 4 cycle engine and measure pistons, cylinders, camshaft, and crankshaft for excessive wear using proper instruments and determines necessary action.

SAMPLE PERFORMANCE TASK

- Diagnose a non-starting 2 or 4 cycle engine by following a manufacturer recommended a manufacturer diagnostic procedure.
- Use diagnostic tools and gauges to compare specifications of engine to manufacturer recommended specifications.
- Compare DMM readings of electrical circuits to manufacturer specifications.
- Check adjustment of points and dwell.
- Use micrometers, calipers, plasti-gauge, straight edge rulers, and other measuring instruments to determine wear on engine components.

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), Equipment & Engine Training Council (EETC), Outdoor Power Equipment (OPEESA)

2 & 4 CYCLE ENGINE III

STANDARD 5.0

Students will complete a 2 cycle and a 4 cycle engine overhaul.

LEARNING EXPECTATIONS

The student will:

- 5.1 Disassemble cylinder head, clean, inspect, and determine action needed.
- 5.2 Inspect valves, valve seats, and valve guides, resurface or replace and perform valve lapping operation and explain why.
- 5.3 Deglaze and clean cylinder bore using a rigid hone.
- 5.4 Inspect valve train including lifters, rocker arms, studs, and push rods and determine needed action.
- 5.5 Inspect and measure camshaft, rod, and main bearings for wear or damage; replace as necessary.
- 5.6 Install all engine components, assemblies, bearings, and gaskets and torque to manufacturer's specifications.
- 5.7 Verify camshaft timing according to manufacturer specifications and adjust valves.
- 5.8 Fill engine with proper fluids (oil and coolant) and test run engine.
- 5.9 Check all safety devices and engine adjustments to manufacturer specifications.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 5.1 Disassembles cylinder head, cleans, inspects, and determines action needed.
- 5.2 Inspects valves, valve seats, and valve guides, resurfaces or replaces and performs valve lapping operation and explains why.
- 5.3 Deglazes and cleans cylinder bore using a rigid hone.
- 5.4 Inspects valve train including lifters, rocker arms, studs, and push rods and determines needed action.
- 5.5 Inspects valve train including lifters, rocker arms, studs, and push rods and determines needed action.
- 5.6 Inspects and measures camshaft, rod, and main bearings for wear or damage; replaces as necessary.
- 5.7 Installs/re-assembles all engine components, assemblies, bearings, and gaskets and torque to manufacturer's specifications.
- 5.8 Verifies camshaft timing according to manufacturer specifications and adjusts valves.
- 5.9 Fills engine with proper fluids (oil and coolant) and test runs engine.
- 5.10 Checks all safety devices and engine adjustments to manufacturer specifications.

SAMPLE PERFORMANCE TASKS

- Disassemble overhead cam type cylinder heads and compare to non-overhead cam cylinder heads.
- Properly use engine hones and measuring instruments to clean and inspect engines.
- Distinguish good engines components to worn, out of tolerance components.
- Correctly uses timing light or measuring tools to determine correct timing of engine.
- Check OEM specifications for lubrication and cooling system fluids.
- Check operation of safety switches and devices and correctly utilize them.

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), Equipment & Engine Training Council (EETC), Outdoor Power Equipment and Engine Service Association (OPEESA)

2 & 4 CYCLE ENGINE III

STANDARD 6.0

Students will develop a business plan for starting a business.

LEARNING EXPECTATIONS

The student will:

- 6.1** Access the U.S. Small Business Administration for information on how to write a business plan.
- 6.2** Access the Tennessee Department of State for information on starting a business in Tennessee.
- 6.3** Access your local county clerks office for local information and regulations on starting a business.
- 6.4** Write a potential budget for a small business operation.
- 6.5** Write a bank loan proposal a new startup business.
- 6.6** Research EPA rules and regulations for leisure craft/outdoor power equipment businesses.

PERFORMANCE INDICATORS: EVIDENCE STANDARD IS MET

The student:

- 6.1A** Uses the Internet to access the U.S. Small Business Administration (www.sba.gov) for information and online courses on how to write a business plan.
- 6.1B** Interviews a small business owner on starting a new small business.
- 6.2A** Accesses the Tennessee State Website (www.tn.gov) and follow business links or go to http://www.state.tn.us/ecd/pdfs/SGB_smart_guide09_final.pdf or <http://www.tennesseeanytime.org/business/smallbusinesses.html> for information on starting a business in Tennessee.
- 6.2B** Researches and charts logical steps in starting a business.
- 6.3** Accesses local county clerks/tax office for local information and regulations on starting a business.
- 6.4** Writes a potential budget for a small business operation.
- 6.5** Writes a bank loan proposal for a new startup business.
- 6.6** Researches EPA rules and regulations for leisure craft/outdoor power equipment businesses.

SAMPLE PERFORMANCE TASKS

- Interview small business owners (lawncare, repair shops, technicians) and list pros and cons.
- Complete a chart for business start up.
- Complete an operating budget of a potential small business.
- Complete a bank proposal/business plan for starting a business.

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), Equipment & Engine Training Council (EETC), Outdoor Power Equipment and Engine Service Association (OPEESA), www.tn.gov , www.sba.gov .

2 & 4 CYCLE ENGINE III

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
- OPEESA (Outdoor Power Equipment and Engine Service Association)