SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Introduction to Small Engine Repair	**Length of Course:** Half Year
Grade Level(s): 10-12	**Periods Per Cycle:** 6
Units of Credit: .5	**Length of Period:** 40 Minutes
Classification: Elective	**Total Instructional Time:** 60 Hours

Course Description

In this course students will be exposed to the mechanics of small 4-Stroke engines. Students will learn the science of a small 4-stroke engine in addition to troubleshooting and maintaining these engines. This course will offer a service to the Spring Grove community. Community members will be able to have small 4-stroke engine machines (mowers, small rototillers, etc.) serviced at the high school.

Instructional Strategies, Learning Practices, Activities, and Experiences

Critical Thinking Guided Practice Warm-up/Closures	Class Discussions Flexible Groups Best Practices Strategies	Teacher Demonstrations Project Examples Hands on Projects

Assessments

Application Projects / Exercises	Written Tests	Verbal Discussions

Materials/Resources

Teacher Generated Materials Small Engines	Textbooks/Workbooks Standard and Specialized Tools	Online Resources Personal Safety Protection

Adopted: 5/24/21
Revised: 5/22/23

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Internal Combustion Engines • Engine Classification • Ignition • Number of Strokes • Cylinder Design • Shaft Orientation • Cooling System • History • Heat • Force • Pressure • Torque • Work • Power	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **PST.01.02.01.a**. Compare and contrast applications of simple machines in AFNR related mechanical systems. **PST.01.01**. Apply physical science and engineering principles to assess and select energy sources for AFNR power, structural and technical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Safety and Tools • Operation Safety • Flammable Liquids • Carbon Monoxide • Personal Protective Equipment • Protective Clothing • Eye Protection • Ear Protection • Respiratory Protection • Hand Protection • Foot Protection • Back Protection • Parts Cleaning • Hazardous Materials Disposal • Hand Tools • Power Tools • Test Tools	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **PST.01.02.03.a**. Examine owner's manuals to classify the types of safety hazards associated with different mechanical systems used in AFNR (e.g., caution, warning, danger, etc.). **PST.01.02.03.b**. Select, maintain, and demonstrate the proper use of tools, machines and equipment used in different AFNR related mechanical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Engine Operation • Engine Components • Engine Block • Cylinder Head • Crankshaft • Piston and Piston Rings • Connecting Rod • Bearings • Flywheel • Valve Train • 4-Stroke Cycle Engines • Intake • Compression • Ignition • Power • Exhaust • Valve Overlap • 4-Stroke Cycle Engine Valving System • 2-Stroke Cycle Engine Valving System	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **PST.02.01.** Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. **PST.02.02.01.c.** Perform pre-operation inspections, start-up and shut-down procedures on equipment, machinery and power units as specified in owner's manuals. **PST.02.02.02.c.** Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Compression System • Compression • Valves • Piston • Piston Rings • Cylinder Bore	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **PST.02.01.** Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. **PST.02.02.01.c.** Perform pre-operation inspections, start-up and shut-down procedures on equipment, machinery and power units as specified in owner's manuals. **PST.02.02.02.c.** Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Fuel System • Fuel • Engine Emissions • Octane • Carburetor Operation Principles • Carburetor Operation • Emulsion Tube and Jets • Fuel Filter	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **PST.02.01.** Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. **PST.02.02.01.c.** Perform pre-operation inspections, start-up and shut-down procedures on equipment, machinery and power units as specified in owner's manuals. **PST.02.02.02.c.** Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Governor System • Governor System Operation Principles • Governor System Components	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **PST.02.01.** Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. **PST.02.02.01.c.** Perform pre-operation inspections, start-up and shut-down procedures on equipment, machinery and power units as specified in owner's manuals. **PST.02.02.02.c.** Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Electrical System • Electrical Principles • Voltage, Current, Resistance • Magnetron Ignition System • Starting System	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **HS-PS3-5.** Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. **PST.02.01.** Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. **PST.02.02.01.c.** Perform pre-operation inspections, start-up and shut-down procedures on equipment, machinery and power units as specified in owner's manuals. **PST.02.02.02.c.** Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Cooling and Lubrication Systems • Engine Heat • Engine Materials and Characteristics • Air-Cooled Engine Cooling Systems • Lubrication • Lubrication Systems	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply the concept that many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **PST.02.01.** Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings. **PST.02.02.01.c.** Perform pre-operation inspections, start-up and shut-down procedures on equipment, machinery and power units as specified in owner's manuals. **PST.02.02.02.c.** Adjust equipment, machinery and power units for safe and efficient operation in AFNR power, structural and technical systems.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Failure Analysis • Engine Failure	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **HS-ETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **HS-ETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. **PST.03.01.** Troubleshoot, service and repair components of internal combustion engines using manufacturers' guidelines. **PST.02.01**. Perform preventative maintenance and scheduled service to maintain equipment, machinery and power units used in AFNR settings.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Engine Application and Selection	**3.4.10.A2.** Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. **3.4.10.A3.** Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. **3.4.12.A3.** Demonstrate how technological progress promotes the advancement of science, technology, engineering, and mathematics (STEM). **3.4.10.B2.** Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. **3.4.10.B3.** Compare and contrast how a number of different factors, such as advertising, the strength of the economy, the goals of a company and the latest fads, contribute to shaping the design of and demand for various technologies. **3.4.12.C3.** Apply many technological problems require a multi-disciplinary approach. **3.4.12.D2**. Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. **3.4.10.D2.** Diagnose a malfunctioning system and use tools, materials, knowledge to repair it. **3.4.10.E3**. Compare and contrast the major forms of energy: thermal, radiant, electrical, mechanical, chemical, nuclear and others. **3.4.12.E6**. Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. **3.4.12.E7**. Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world. **3.4.10.E7.** Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. **HS-ETS1-2.** Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **HS-ETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. **PST.01.** Apply physical science principles and engineering applications to solve problems and improve performance in AFNR power, structural and technical systems.