

SAULT COLLEGE OF APPLIED ARTS AND TECHNOLOGY

SAULT STE. MARIE. ON

COURSE OUTLINE

COURSE TITLE: TRADE THEORY

CODE NO.: MSEOIO SEMESTER: 20 WEEKS

PROGRAM: 8016 MARINE & SMALL ENGINES

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DATE: 1995 PREVIOUS OUTLINE DATED: N/A

APPROVED:



Dean, School of Technical Trades

DAfE

TOTAL CREDITS 11

PREREQUISITE(S): Grade 10 or BTSD Level 3 equivalent

L PHILOSOPHY/GOALS: Upon successful completion of this course, students will be able to identify shop safety procedures; identify tools commonly used in the trade; explain the theory of operations of two and four stroke cycle spark ignition engines; be able to carry out the diagnostic procedures and repair the common systems and components used in the marine industry. The student will acquire general knowledge and develop basic skills of the components and how they compare on the various engines.

IL STUDENT PERFORMANCE OBJECTIVES (OUTCOMES):

Upon successful completion of this course the student will:

- 1) be able to Identify shop safety procedures (testing of engines, mixing and handling of fuels)
- 2) know the proper use of tools commonly used in the trade (wrenches, sockets, all drivers and speciality tools)
- 3) be able to relate to the theory of operation of two and four stroke cycle spark ignition engines (all engine components)
- 4) be able to carry out diagnostic procedures and repair the most common systems and components used in the industry (use of testing, meters and gauges)

in. TOPICS TO BE COVERED:**Approximate Time
Frames (Optional)**

- 1) Safety In the Small Gas Engine Shop
- 2) Engine Construction & Principles of Operation
- 3) Two Cycle, Four Cycle and Rotary Engines
- 4) Fuel Systems
- 5) Carburetion
- 6) Ignition Systems
- 7) Engine Lubrication
- 8) Engine Cooling
- 9) Measuring Engine Performance
- 10) Tools and Measuring Instruments
- 11) Troubleshooting, Service and Maintenance
- 12) Fuel System Service
- 13) Ignition System
- 14) Cylinder Reconditioning
- 15) Pistons *ii* Piston Rings
- 16) Rods, Bearings and Valves
- 17) Small Gas Engine Applications
- 18) Career Opportunities
- 19) Basic Diesel Fundamentals

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Topic/Unit - Chapter 1 - Safety in the Small Gas Engine Shop

Learning Activities: Students will learn why a clean, well-organized shop is extremely important. Several dangers will be listed that are associated with working in small engine shop. The importance of maintaining and using tools properly will be explained. Students will describe methods for minimizing the risks involved in working with small engines.

Small Gas Engines Textbook

Topic/Unit - Chapter 2 - Engine Construction & Principles of Operation

Learning Activities: Instructor will explain a simple engine operation, listing the qualities of gasoline that make it an efficient fuel for small engines. An explanation of why gasoline is atomized in the small engine will be given. Students will learn to identify the basic components of a small engine and be able to describe the function of each part.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 3 - Two Cycle, Four Cycle and Rotary Engines

Learning Activities: Instructor will describe four-stroke engine operation and explain the purpose of each stroke. The concept of valve timing will be explained. Students will compare the lubrication system in a four cycle engine to the system in a two cycle engine. Students will learn the operation of a two-stroke cycle engine and be able to explain the principles of two cycle operation. The advantages and disadvantages of two cycle and four cycle engines will be listed. Students will learn to identify the components of a Wankel rotary engine and will summarize rotary engine operation.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 4 - Fuel Systems

Learning Activities: Various types of fuel that can be used in a small engine will be covered, as well as practical applications for each. Students will learn the importance of proper fuel-oil mixture in a two cycle engine, the purpose of fuel filters, and the operation of the fuel pump. They will be able to describe the operation of a pressurized fuel system.

Resources:

Small Gas Engines Textbook

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Topic/Unit - Chapter 5 - Carburetion

Learning Activities: Principles of carburetion will be explained. Students will list the principles of carburetion and identify the three basic types of carburetors. Both float-type carburetors and diaphragm-type carburetors will be explained. Manual throttle controls will be defined and students will list the basic functions of a governor. Students will adjust and maintain common governors and describe the purpose of an air cleaner.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 6 - Ignition Systems

Learning Activities: Instructor will list the primary purposes of the ignition system and identify the components in a typical magneto system and describe the function of each part. The instructor will describe the small engine ignition advance systems and list the advantages of a solid state ignition system. Students will learn to identify the three general classifications of magneto ignition systems and explain the operation of each. They will also be able to describe the operation of a battery ignition system.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 7 - Engine Lubrication

Learning Activities: Instructor will define friction and explain how it affects internal engine components. The functions of lubricating oil will be listed and students will learn to differentiate between the lubrication systems in two cycle and four cycle engines. The operation of ejection pumps, barrel pumps and positive displacement pumps will be covered. Students will also review the function of oil filter systems and differentiate between the three main types.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 8 - Engine Cooling

Learning Activities: Air Cooling, exhaust cooling and water cooling and how they work to lower engine operating temperatures will be reviewed. Students will be able to define the basic function of a water pump and give examples of several common types. They will be able to describe the basic operation of outboard water circulation systems and explain the function of a thermostat and a radiator.

Resources:

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Topic/Unit - Chapter 9 - Measuring Engine Performance

Learning Activities: Engine performance will be defined, as well as compute bore, stroke, displacement, compression ration, force, work, power energy and horsepower. Students will learn to differentiate between the various types of horsepower. The function of a prony brake and a dynamometer will be explained. Students will learn to define and calculate torque. Volumetric efficiency, practical efficiency, mechanical efficiency and thermal efficiency will also be covered.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 10 - Tools and Measuring Instruments

Learning Activities: Students will be able to explain why quality tools and measuring instruments should be used when servicing small gas engines and be able to summarize the reasons that small engine components must be measured carefully. Several common measuring techniques will be demonstrated and the proper use of hand tools will be covered.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 11 - Troubleshooting, Service and Maintenance

Learning Activities: Systematic troubleshooting will be described. Students will use manufacturer's service manuals to determine engine specifications and explain why this information is necessary when servicing a small engine. Students will change the oil in a 4 cycle engine and mix fuel and oil correctly for a 2 cycle engine. Students will perform preventive maintenance on various engine systems, including the crankcase breather, air cleaner and muffler. They will also prepare an engine and cooling system for storage.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 12 - Fuel System Service

Learning Activities: A fuel pump will be tested for proper operation and basic carburetor adjustments will be summarized. Two cycle engine reed will be tested for leakage. The basic procedures for inspecting, overhauling and adjusting diaphragm and float-type carburetors will be explained. Troubleshooting diaphragm and float-type carburetors will also be covered.

Resources:

Small Gas Engines Textbook

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Topic/Unit - Chapter 13 - Ignition System

Learning Activities: Spark plug deposits will be examined for signs of abnormal combustion. Students will learn to clean, gap and install spark plugs correctly, Basic inspections and tests used to verify proper ignition system operation will be explained. Students will adjust breaker points, piston height and ignition spark timing. Basic tests for breaker point and solid state ignition systems will be explained. Typical service procedures for battery ignition systems will be explained.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 14 - Cylinder Reconditioning

Learning Activities: Engines will be inspected for problems and the procedure for removing an engine from an implement will be described. The steps involved in disassembling an engine will be listed. A cylinder will be measured for wear and out-of-roundness. The procedures involved in reboring a cylinder will be explained and the reasons for honing a cylinder will be summarized.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 15 - Pistons & Piston Rings

Learning Activities: A piston and piston ring construction will be described. Students will learn to differentiate between compression rings and oil control rings. The purpose of a ring and gap will be explained. Students will identify common types of piston damage and list possible causes. What happens during piston ring wear-in will be summarized and the purpose of a piston pin will be explained.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 16 - Rods, Bearings and Valves

Learning Activities: The function of the connecting rod and the bearings will be described and bearing spread and bearing crush will be defined. Students will learn to differentiate between friction bearings and antifriction bearings. The function of the crankshaft will be summarized and students will service conventional and overhead valve assemblies. The operation of ports, reeds and rotary valves will be explained. The purpose of the camshaft will be described and the purpose of an automatic compression release will be explained.

Resources:

Small Gas Engines Textbook

IV. LEARNING ACTIVITIES/REQUIRED RESOURCES

Topic/Unit - Chapter 17 - Small Gas Engine Applications

Learning Activities: Features to consider when purchasing a lawn mower will be listed and basic lawn mower maintenance procedures and safety precautions will be summarized. The proper method for storing a lawn mower for long periods of time will be described. The features to consider when purchasing a chain saw or an edger/trimmer will be listed. The maintenance, safety and storage procedures for chain saws and edger/trimmers will be summarized.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 18 - Career Opportunities

Learning Activities: Several career opportunities will be identified in the small gas engine field. Students will list qualities that are essential for anyone pursuing a career in small engines.

Resources:

Small Gas Engines Textbook

Topic/Unit - Chapter 19 - Basic Diesel Fundamentals

Learning Activities: Instructor will cover diesel applications and advantages, basic types of engines, diesel fuels, combustion chamber types and fuel handling.

Resources:

Small Gas Engines Textbook
Diesel Fundamentals

V, EVALUATION METHODS: (INCLUDES ASSIGNMENTS, ATTENDANCE REQUIREMENTS, ETC.)

Written or multiple choice tests at the end of each topic

Term tests are weighted at 60%

Final Exam will cover all material and weighted at 40% of final theory average

VI. PRIOR LEARNING ASSESSMENT:

Students who wish to apply for advanced credit in the course should consult the instructor. Credit for prior learning will be given upon successful completion of the following:

VII. REQUIRED STUDENT RESOURCES

Small Gas Engines Textbook

Small Gas Engines Workbook

VIII. ADDITIONAL RESOURCE MATERIALS AVAILABLE IN THE COLLEGE LIBRARY:

Book Section (TITLE, PUBLISHER, EDITION, DATE, LIBRARY CALL NUMBER IF APPLICABLE - SEE ATTACHED EXAMPLE)

Periodical Section (MAGAZINES, ARTICLES)

Audiovisual Section (FILMS, FILMSTRIPS, TRANSPARENCIES)

IX. SPECIAL NOTES

Students with special needs (eg. physical limitations, visual impairments, hearing impairments, learning disabilities) are encouraged to discuss required accommodations confidentially with the instructor.

Your instructor reserves the right to modify the course as he/she deems necessary to meet the needs of students.