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ABSTRACT

This document presents an outline for a 135-hour course designed to help students become employable with the skills, knowledge, attitudes, and values necessary for performing the required services of the automotive fuel and carburetor systems mechanic. The course is an introduction to the automobile fuel and carburetion systems. Basic manipulative skills relating to carburetor maintenance and overhaul together with adjustments of linkages and fuel indicating circuits are covered. The course outline covers the course orientation; service, tools, equipment and materials; the fuel system; and an introduction to carburetion. The behavioral objectives and performance standards necessary for a person to become an automobile fuel and carburetor mechanic are specified. A twelve-item bibliography and a Quinnester post test sample are included. (KP)

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AUTHORIZED COURSE OF INSTRUCTION FOR THE

QUINMESTER PROGRAM



U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
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Course Outline
AUTOMOTIVE MECHANICS 3 - 9047
(Automotive Fuel and Carburetor)
Department 48 - Quin 9047.01

CE001440

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1973

ED 092711

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Course Outline

AUTOMOTIVE MECHANICS 3 - 9047
(Automotive Fuel and Carburetor)

Department 48 - Quin 9047.01

county office of
VOCATIONAL AND ADULT EDUCATION

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Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

February, 1973

Published by the School Board of Dade County

Course Description

| <u>9047</u> State Category Number | <u>48</u> County Dept. Number | <u>9047.01</u> County Course Number | <u>Automotive Fuel and Carburetor</u> Course Title |
|---|-------------------------------------|---|---|
|---|-------------------------------------|---|---|

This course is an introduction to the automobile fuel and carburetion systems. Basic manipulative skills relating to carburetor maintenance and overhaul together with adjustments of linkages, fuel indicating circuits will be de- and included using test equipment in a shop environment. This is a two or three quinmester credit course.

Indicators of Success: Prior to entry into this course, the vocational student will display mastery of the skills indicated in Automotive Electrical and Electronic System II (9045.04).

Clock hours: 135

PREFACE

The following quinmester course outline is a guide to help students become employable with the skills, knowledge, attitudes and values necessary for performing the required services of the automotive fuel and carburetor systems.

The course is designed as a foundation course for the automotive engine mechanic. This outline consists of five blocks of instruction, which are subdivided into several units each. This course is 135 hours in length.

Indicators for success in the student should have an eighth grade equivalency score in reading, comprehension, arithmetic fundamentals, and mechanical aptitudes.

Instruction will consist of demonstrations, lectures, group discussions, audio-visual aids and resource people from industry. Instruction will be flexible to meet individual needs and abilities.

The bibliography appearing on the last page of this outline lists several basic references along with supplementary references and audio-visual aids.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee, and the Vocational Curriculum Materials Service, and has been approved by the Dade County Vocational Curriculum Committee.

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with Suggested Hourly Breakdown

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| BLOCK | |
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| I. ORIENTATION (1 Hour) | |
| Objectives of the Course | 1 |
| Student Benefits | 1 |
| Student Responsibilities | 1 |
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| II. SERVICE, TOOLS, EQUIPMENT AND MATERIALS (4 Hours) | |
| Hand Tool Kit | 1 |
| Carburetor Tool Kit | 1 |
| Fuel System and Carburetor Equipment | 1 |
| Sources of Fuel System and Carburetor Specifications | 2 |
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| III. FUEL SYSTEM (30 Hours) | |
| Identifying Parts of Fuel System | 2 |
| Fuel Tank | 2 |
| Fuel Pumps | 2 |
| Fuel Lines | 2 |
| Manifold Heat Control Valve | 2 |
| Testing the Fuel Pump | 2 |
| Filters and Filter Service | 3 |
| Methods of Testing Filters | 3 |
| | |
| IV. INTRODUCTION TO CARBURETION (100 Hours) | |
| Review of Internal Combustion Engine Fundamentals | 3 |
| Conditions Affecting Carburetion | 3 |
| Carburetor Fundamentals | 3 |
| Carburetor Circuits - Function and Purpose | 4 |
| Carburetor Components | 4 |
| Carburetor Service Needs | 4 |
| Identifying Major Types and Manufacturers | 5 |
| Determining Car Application of Major Makes | 5 |
| Diagnosing Carburetor Problems on Car with Test Equipment | 5 |
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GOALS

The student must be able to demonstrate:

1. The skills and knowledge required to perform maintenance, service and repairs on the automotive fuel, carburetor and related systems.
2. The ability for accuracy and precision when trouble shooting and making a diagnosis of the automotive fuel system and carburetor.
3. Positive attitudes regarding the value and dignity of work.
4. Pride and respect of craftsmanship for this occupational field.
5. Safe work habits and proper shop behavior to guard against accidents.
6. An incentive to continue with more advanced training within this occupational field.

SPECIFIC BLOCK OBJECTIVES

BLOCK I - ORIENTATION

The student must be able to:

1. Demonstrate an understanding for opportunities that are available for careers in automotive mechanical occupations.
2. State what will be expected of him as an automotive engine mechanic.
3. Demonstrate understanding, knowledge, and skills which will prepare him for a safe working life.
4. Demonstrate an understanding of shop organization, safety rules, and regulations.
5. Demonstrate pride and respect for craftsmanship.
6. Evidence understanding and acceptance of his own duties and responsibilities.

BLOCK II - SERVICE TOOLS, EQUIPMENT AND MATERIALS

The student must be able to:

1. Define the general types of tools and their use.
2. To effectively select and use the applicable tools and perform the bench skills in the proper manner.
3. Demonstrate the proper care and maintenance of tools and equipment.
4. Exhibit the ability to practice safety precautions in the use of tools and equipment.

BLOCK III - FUEL SYSTEM

The student must be able to:

1. Describe orally or in written fashion the principles of the fuel system.
2. Demonstrate an understanding of the basic fundamentals of the fuel system.
3. Demonstrate an understanding of the fuel system parts and their function.
4. Explain the related systems of the fuel systems.
5. Perform maintenance, service and repairs of the fuel system and its related systems within acceptable standards.
6. Demonstrate the skills necessary for trouble-shooting and diagnosis of the fuel system and its related systems.
7. Exhibit the ability to perform acceptable work on the fuel system.

BLOCK IV - INTRODUCTION TO CARBURETION

The student must be able to:

1. Describe orally or in written fashion the basic fundamentals of the carburetor.
2. Demonstrate an understanding of carburetor system parts and their functions.
3. Explain the related systems of the carburetor.

4. Exhibit the ability to perform maintenance, repair and service of the carburetor and related systems.
5. Demonstrate the skills necessary for trouble-shooting and diagnosis of the automotive carburetor and related systems.

Course Outline

AUTOMOTIVE MECHANICS 3-9047 (Automotive Fuel and Carburetor)

Department 48 - Quin 9047.01

I. ORIENTATION

- A. Objectives of the Course
 - 1. Standards
 - 2. Methods of evaluation:
 - a. Written tests
 - b. Oral
 - c. Manipulation
 - d. Diagnosis and job performance
 - 3. Teaching methods

- B. Student Benefits
 - 1. Opportunities for employment:
 - a. Scope of the trade
 - b. Job opportunities
 - 2. Qualifications for employment
 - a. Job competency
 - b. Pride of workmanship
 - c. Attitude
 - d. Dependability
 - e. Trade certificate
 - f. Foundation for more education and training
 - g. Experience

- C. Student Responsibilities
 - 1. School policies and expenses
 - 2. Safety regulations
 - 3. Shop rules and procedures
 - a. Care of hand tools
 - b. Use and care of equipment
 - c. Reporting defective equipment
 - d. Reporting loss of equipment
 - e. Materials and supplies
 - f. Housekeeping
 - g. Employee-employer relations
 - h. Employee-customer relations

II. SERVICE, TOOLS, EQUIPMENT AND MATERIALS

- A. Hand Tool Kit
- B. Carburetor Tool Kit
- C. Fuel System and Carburetor Equipment

- D. Sources of Fuel System and Carburetor Specifications
 - 1. Exhaust gas analyzer
 - 2. Vacuum and pressure gauge
 - 3. Emission analyzer
 - 4. Tachometer

III. FUEL SYSTEM

- A. Identifying Parts of Fuel System
 - 1. Fuel tank
 - 2. Fuel lines
 - 3. Fuel pump
 - 4. Filter
 - 5. Carburetors and air cleaners
 - a. Superchargers
 - b. Fuel injection
 - 6. Carburetor linkage
 - 7. Carburetor air pre-heat
 - a. Intake manifold
 - b. Exhaust manifolds
 - c. Vacuum controls
 - 8. Gauges and sending units
- B. Fuel Tank
 - 1. Construction
 - 2. Tank-gas-gauge unit
 - 3. Venting system
- C. Fuel Pumps
 - 1. Types of pumps:
 - a. Single action
 - b. Double action
 - c. Electric
 - 2. Principles of pump operation
- D. Fuel Lines
 - 1. Steel lines
 - 2. Flexible lines neoprene hose
 - a. Visual inspection
 - b. Procedure for removing and replacing
 - c. Procedure for flaring a gas line
 - d. Types of fittings and connections used
- E. Manifold Heat Control Valve
 - 1. Purpose of the valve
 - 2. Checking and servicing the valve
- F. Testing the Fuel Pump
 - 1. Pressure test
 - 2. Volume test
 - 3. Vacuum test
 - a. At pump
 - b. At tank connection

- G. **Filters and Filter Service**
 - 1. **Types of filters**
 - a. **Air cleaner**
 - b. **In line filters**
 - c. **Carburetor filters**
 - 2. **Air-cleaner light test**

- H. **Methods of Testing Filters**
 - 1. **Combustion tests**
 - 2. **Volume test**
 - 3. **Location and replacement procedures of carburetor filters**

IV. INTRODUCTION TO CARBURETION

- A. **Review of Internal Combustion Engine Fundamentals**
 - 1. **Four stroke cycle**
 - 2. **Compression ratio**
 - 3. **Compression pressures**
 - 4. **Valves and camshaft function**
 - 5. **Valve overlap**

- B. **Conditions Affecting Carburetion**
 - 1. **Engine mechanical conditions**
 - a. **Compression pressures**
 - b. **Valve adjustment**
 - c. **Intake manifold leaks**
 - d. **Clogged air cleaner**
 - 2. **Electrical system conditions**
 - a. **Spark plug**
 - b. **Vacuum advance**
 - c. **Centrifugal advance**
 - d. **Timing**
 - e. **Coil**
 - f. **Ballast resistor**
 - g.
 - 3. **Exhaust system**
 - a. **Collapsed exhaust pipe**
 - b. **Clogged muffler**

- C. **Carburetor Fundamentals**
 - 1. **Air-fuel ratio**
 - 2. **Fluids and air flow - pressure vs. vacuum**
 - 3. **Pressure vs. air velocity**
 - 4. **Venturi action**
 - 5. **Carburetor venting**
 - a. **External**
 - b. **Internal**
 - 6. **Effects of temperature changes on gasoline**
 - a. **Vapor lock**
 - b. **Percolation**

D. Carburetor Circuits - Function and Purposes

1. Float
2. Choke
3. Idle
4. Intermediate
5. High speed
6. Pump
7. Power

E. Carburetor Components

1. Float
 - a. Needle and seat
 - b. Float pontoon
2. Idle
 - a. Calibrated idle tubes
 - b. Air bleeds
 - c. Discharge holes
 - d. Mixture screws
3. Intermediate
 - a. Discharge holes
 - b. Main discharge nozzles
4. High-speed circuit
 - a. Main metering jets
 - b. Main discharge nozzles
5. Pump circuit
 - a. Pump plunger or diaphragm
 - b. Discharge check ball or needle
 - c. Intake check ball
 - d. Discharge passage
3. Pump linkage
6. Power circuit
 - a. Power valve
 - b. Power piston or diaphragm
 - c. Vacuum passages
 - d. Check balls
7. Choke circuit
 - a. Choke valve
 - b. Choke piston
 - c. Thermostatic coil spring
 - d. Fast idle cam
 - e. Related linkage
 - f. Vacuum passages
 - g. Heated passages
 - h. Choke diaphragm

F. Carburetor Service Needs

1. Specifications
2. Float adjustments
 - a. Height - toe and heel
 - b. Drop
 - c. Alignment
3. Pump rod adjustments
4. Choke adjustments
5. Idle vent adjustments
6. Unloader adjustments

7. Secondary throttle lockout adjustments
 8. Throttle stop and mixture adjustments
 9. Anti-stall dash pot
- G. Identifying Major Types and Manufacturers
1. Single barrel
 2. Double barrel
 3. Four barrel
- H. Determining Car Application of Major Makes
1. Carter
 2. Rochester
 3. Holly
 4. Ford
- I. Diagnosing Carburetor Problems On Car With Test Equipment
- J. Carburetor Heat Control-Operation
1. Exhaust system
 - a. Manifold passages
 - b. Gaskets
 2. Cooling system
 - a. Base plate
 - b. Hoses and passages
 3. Hot and cold air control
 - a. Ducting
 - b. Valve
- K. Vehicle Emission Controls
1. Engine pollutants
 - a. Hydrocarbons
 - b. Carbon monoxide
 - c. Nitrogen oxide
 2. Federal emission standards
 - a. Present standard 1972, 3.4 grams per mile Hydrocarbons (HC) and 39.0 (CO) Carbon Monoxide
 - b. 1975 standard, .9 grams per mile nox nitrogen oxide
 - c. 1976 standard, .4 grams per mile of nitrogen oxide
 3. Transmission regulated spark control system
 4. Electronic spark control system
 5. Emission control standards
 6. Positive crankcase ventilation system
 7. Controlled combustion system
 8. Air injector reaction
 9. Exhaust gas recirculation
 10. Evaporative emission control system

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2. _____ . Automotive Mechanics. New York: Webster Division, McGraw-Hill Book Co., 1965. Pp. 616.

Supplementary References:

3. Carburetor Service Manual. Ford Marketing Corporation Autolite-Ford Parts Division, National Service Department.
4. Chilton Auto Repair Manual. 3rd ed. Philadelphia: Chilton Company, 1962. Pp. 1250.
5. Crankcase and Exhaust Emission Systems Service Manual. Flint Michigan: AC Spark Plug Division, General Motors Corporation.
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10. Vehicle Emission Control Manual. Washington, D. C.: Division of Manpower, U. S. Office of Education.

A P P E N D I X

Quinmester Post-Test Sample

Quinmester Post-Test

Name _____ Date _____ Score _____

Multiple Choice Test Items

Each statement needs a word a figure or a phrase to make it correct. Only one of the choices listed is correct. Place the number of the choice you make in the space provided at the left edge of the sheet.

- ___ 1. When the engine is cold, the manifold heat control causes hot exhaust gases to circulate through a jacket around the:
1. exhaust manifold
 2. intake manifold
 3. exhaust pipe
 4. tail pipe
- ___ 2. The fast-idle cam, which is linked to the automatic choke valve, cause the engine to idle fast when the engine is:
1. overheated
 2. warm
 3. cold
 4. none of these
- ___ 3. The antiknock valve of gasoline is referred to in terms of:
1. compression number
 2. heptane number
 3. volatility number
 4. octane number
- ___ 4. So-called wild knocking, which may result from hot spots in the combustion chamber, is due to:
1. detonation
 2. high octane
 3. preignition
 4. none of these
- ___ 5. Electrically operated fuel gauges are of two types:
1. balancing-coil and hydrostatic
 2. bimetal-thermostat and hydrostatic
 3. balancing-coil and bimetal-thermostat
 4. none of these
- ___ 6. The tank unit of the balancing-coil fuel gauge contains a:
1. variable resistance
 2. bimetal thermostat
 3. switch
 4. capacitor

- ___ 7. The tank unit of the bimetal-thermostat fuel gauge has:
1. a variable resistance
 2. a heating coil
 3. a pointer
 4. an armature
- ___ 8. In the fuel pump, the rocker arm which rests against an eccentric on the camshaft, is linked to the:
1. inlet valve
 2. outlet valve
 3. diaphragm
 4. none of these
- ___ 9. The air cleaner mounted on the carburetor air horn has two jobs to:
1. filter fuel and silence intake
 2. filter air and restrict dirt
 3. filter air and silence intake
 4. none of these
- ___ 10. The most commonly used automatic choke is operated by:
1. vacuum and solenoid
 2. vacuum and thermostat
 3. thermostat and temperature
 4. none of these
- ___ 11. As the engine warms up, winding up of the thermostat in the automatic choke causes the choke valve to:
1. close
 2. release the vacuum piston
 3. open
 4. none of these
- ___ 12. The main purpose of the compensating valve on air conditioned: equipped cars is to:
1. prevent stalling due to vapor formation
 2. prevent percolation from the gas tank
 3. protect fuel pump diaphragm
 4. none of these
- ___ 13. Location of trouble in a fuel gauge system can usually be located by temporarily substituting a:
1. new switch
 2. new wire
 3. new tank unit
 4. none of these

- ___ 14. Worn carburetor jets or a clogged air cleaner will cause:
1. full power operation
 2. spark knock
 3. high fuel consumption
 4. none of these
- ___ 15. When gasoline evaporates in the fuel line or fuel pump it produces a condition called:
1. fuel lock
 2. viscosity lock
 3. engine lock
 4. vapor lock
- ___ 16. The main reason for a venturi in a carburetor is to:
1. restrict the air flow
 2. create a low pressure area
 3. feed fuel to the engine for idle speeds
 4. supply air to the float chamber
- ___ 17. What is the purpose of the float in the carburetor?
1. To maintain the correct fuel level in the bowl for all requirements.
 2. To prevent the engine from stalling.
 3. To increase economy.
 4. None of these.
- ___ 18. Why is the float drop adjustment important?
1. To prevent flooding.
 2. For quicker cold starting.
 3. To insure maximum fuel flow.
 4. To insure proper fuel level.
- ___ 19. At idle speed, the idle needle hole is supplying:
1. Air only
 2. Fuel only
 3. Atomized fuel
 4. Vaporized fuel only
- ___ 20. During normal part throttle operation, the main fuel supply is through:
1. the idle needle hole
 2. main circuit
 3. the power valve
 4. the pump circuit

- ___ 21. The accelerator pump must supply fuel when the throttle is suddenly opened because:
1. there is momentarily no vacuum at the fuel nozzle
 2. there is a lag in the speed-up of fuel flow
 3. the engine can accelerate only on liquid fuel
 4. none of these
- ___ 22. The power valve's main function is to:
1. give economy at high speeds
 2. provide full power
 3. shut off gas to the small venturi
 4. none of these
- ___ 23. The power valve provides:
1. a richer mixture at high speed
 2. a leaner mixture at high speed
 3. the same mixture at high speed
 4. none of these
- ___ 24. Atomization in a carburetor means:
1. keeping the fuel in liquid form as long as possible
 2. heating the fuel
 3. breaking the fuel up into small particles
 4. condensing the fuel
- ___ 25. Gasoline can be cleared from the cylinders of a flooded engine by holding the throttle wide open while cranking the engine, because of the action of the:
1. vaporizer
 2. scavenger
 3. lockout
 4. unloader
- ___ 26. The purpose of the fuel tank vent is to:
1. allow fumes to escape
 2. prevent possibility of an explosion
 3. help vaporize the fuel
 4. maintain atmospheric pressure in the tank
- ___ 27. A balanced carburetor must have:
1. a concentric fuel bowl
 2. an anti-percolator valve
 3. a vent to the air horn
 4. an offset throttle valve shaft

- ___ 28. A rich mixture could be caused by:
1. high float level
 2. low float level
 3. choke valve stuck open
 4. a crack in the fuel pump diaphragm
- ___ 29. Worn carburetor jets will cause:
1. full power operation
 2. fast engine warmup
 3. detonation
 4. high fuel consumption
- ___ 30. The function of a carburetor air bleed is to:
1. break up liquid gasoline into a mixture
 2. bypass air from the nozzle to the bowl
 3. prevent siphoning at high speed
 4. cool the mixture to increase power
- ___ 31. The function of the manifold heat control is to:
1. preheat the liquid fuel from the fuel pump so it will provide more readily
 2. by-pass exhaust heat around the intake manifold when the engine is cold
 3. regulate the amount of vacuum admitted to the climatic control thermostat
 4. vaporize moisture in the crankcase so the ventilating system will carry it off and prevent formation of sludge

ANSWER KEY TO QUINMESTER POST-TEST

- | | |
|-------|-------|
| 1. 2 | 17. 1 |
| 2. 3 | 18. 3 |
| 3. 4 | 19. 3 |
| 4. 3 | 20. 2 |
| 5. 3 | 21. 2 |
| 6. 1 | 22. 2 |
| 7. 2 | 23. 1 |
| 8. 3 | 24. 3 |
| 9. 3 | 25. 4 |
| 10. 2 | 26. 4 |
| 11. 3 | 27. 3 |
| 12. 1 | 28. 1 |
| 13. 3 | 29. 4 |
| 14. 3 | 30. 1 |
| 15. 4 | 31. 2 |
| 16. 2 | |