

**FREEHOLD REGIONAL HIGH SCHOOL DISTRICT**

**OFFICE OF CURRICULUM AND INSTRUCTION**

**TECHNOLOGY EDUCATION DEPARTMENT**

# **AUTOMOTIVE 2**

Grade Level: 10-12

Credits: 5

**BOARD OF EDUCATION ADOPTION DATE:**

**AUGUST 25, 2008**

[SUPPORTING RESOURCES AVAILABLE IN DISTRICT RESOURCE SHARING](#)

APPENDIX A: ACCOMMODATIONS AND MODIFICATIONS

APPENDIX B: ASSESSMENT EVIDENCE

APPENDIX C: INTERDISCIPLINARY CONNECTIONS

## Table of Contents

Course Description	1
Proficiencies	2
Course Content Outline	3
Suggested Teaching Procedures	14
Time-Line Periods	15
Suggested Materials and Equipment	16

## Course Description

Grades 11 and 12  
5 credits, full year

Automotive II is designed to increase the student's knowledge of automobile operation and repair. Students will continue to develop their skills by using advanced techniques and more complex pieces of test equipment, which are normally found in the Auto Industry.

The information presented can be used by all students regardless of whether they are academically or vocationally oriented. The vocationally oriented students will be provided with an opportunity to develop entry level skills whereas academic students can further develop their consumer knowledge and avocational interest.

Areas of instruction include the ignition system, electronic engine management, charging systems, brakes, alignment and front suspension, power trains, carburetion, fuel injection, turbo-charging and accessories. The use of the computerized engine and emissions analyzer will be expanded and used throughout the course. Career and occupational information will also be presented.

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Students enrolled in this course will demonstrate mastery of the following proficiency requirements as outlined in the curriculum guide and receive a passing grade in accordance with Board of Education policies on grading and attendance:

1. Demonstrate an understanding of basic skills in reading, mathematics, and science, particularly as they relate to Automotive II terminology.
2. Know and apply appropriate shop safety rules and regulations prescribed by New Jersey State Laws and Board of Education policy.
3. Demonstrate the safe operation and use of various machines, hand tools, and supplies in this shop, as outlined in the curriculum guide.
4. Demonstrate desirable work habits and attitudes and the ability to work individually or in a group.
5. Perform and successfully complete teacher assigned shop activities in class.
6. Become familiar with career and leisure opportunities related to Automotive Technology.
7. Develop knowledge of ignition systems: conventional and electronic.
8. Increase knowledge and skills related to both disc and drum type brake systems.
9. Develop knowledge and skills related to front end service.
10. Develop knowledge and skills in the fundamentals of computerized engine management.
11. Develop knowledge and skills related to automotive power trains.
12. Develop knowledge and skills needed to make technical analysis of mechanical engine components.
13. Demonstrate the ability to read diagnostic equipment.
14. Develop skills and knowledge in the use of the computerized test center to solve engine management systems problems.
15. Develop skills to test and repair automotive emissions to meet state standards through the use of a computerized emissions analyzer.

To measure mastery in accordance with grading policy, attendance policy and other policies of the Board of Education, the teacher will select appropriate evaluative methods as listed below.

Student effort  
Classwork  
Unit tests  
Term papers  
Department exam  
Lab reports

Performance relative to ability  
Quizzes  
Final exams  
Book reports and outside readings  
Standardized tests

## Course Content Outline

- I. Introduction
  - A. Course description/goals
    - 1. Proficiency requirements
    - 2. Evaluation
    - 3. Homework policy
  - B. Orientation
    - 1. Classroom procedures
    - 2. Fire drills/exit
  - C. Automotive shop safety
    - 1. District safe guide
    - 2. Related New Jersey State Laws
  - D. Student responsibility
  - E. Review and testing
- II. Electrical/Electronics
  - A. Ignition
    - 1. Contact point system
      - a. designs
      - b. theory of operation
      - c. components
        - 1. distributor
          - a. components
          - b. cam angle/point gap
          - c. advance mechanism
      - d. service
        - 1. component replacement
        - 2. cam angle/point gap adjustment
        - 3. ignition timing
        - 4. distributor removal and replacement
    - 2. Electronic system
      - a. designs
      - b. theory of operation
      - c. components
        - 1. distributor
          - a. magnetic pick-up
          - b. hall effect sensor
        - 2. electronic control unit/amplifier
        - 3. coils
        - 4. wiring
        - 5. GM high energy system
    - 3. Safety
      - a. personal
      - b. vehicle
  - B. Electronic Engine Management
    - 1. Components
      - a. electronic control module
      - b. elctro-mechanical carburetor/fuel injection

- c. air management system
- d. catalytic converter
- e. engine sensors
  - 1. oxygen
  - 2. vacuum
  - 3. temperature
  - 4. throttle position
  - 5. engine RPM's
- 2. Computer Operation
  - a. open loop
    - 1. governing conditions
    - 2. input sensors
    - 3. output sensors
  - b. close loop
    - 1. governing conditions
    - 2. input signals
      - a. oxygen sensors
      - b. vacuum sensors
      - c. coolant sensors
      - d. throttle position sensors
      - e. RPM's sensor
  - c. output sources
    - 1. M/C solenoid or fuel injector
    - 2. air management system
    - 3. distributor
    - 4. other
  - d. service
    - 1. testing
      - a. use of hand held portable equipment
      - b. use of computerized diagnostic tester
    - 2. component replacement
    - 3. handling precautions/safety
- C. Tune-up
  - 1. Pre tune-up/mechanical
    - a. visual inspection
    - b. computer diagnostic test
    - c. emission test
  - 2. Tune-up
    - a. preventative maintenance tune-up
      - 1. time scheduled part replacement
      - 2. worn part replacement
      - 3. maintenance
      - 4. adjustments
      - 5. retest
    - b. diagnostic tune-up/engine problem
      - 1. engine analyzed to identify system
      - 2. system tested to identify part
      - 3. part replacement
      - 4. retest

- D. Charging system
  - 1. Alternators
    - a. design
    - b. operation
      - 1. diodes
      - 2. stator
      - 3. rotor
  - 2. Regulation
    - a. external regulator
      - 1. mechanical
      - 2. transistorized
    - b. internal regulator
  - 3. Testing/service
    - a. performing an alternator output test
    - b. Ohm meter
    - c. oscilloscope diode patterns
  - 4. Precautions/safety
- E. Starting systems
  - 1. Starter motors
    - a. construction/operation
      - 1. armature
      - 2. filed coils
      - 3. bendix/overrunning clutch drives
      - 4. gear reduction
  - 2. Controls
    - a. relays
    - b. solenoids
    - c. ignition switch/neutral safety switch
    - d. clutch pedal switches
  - 3. Testing/service
    - a. performing a load/no load test
    - b. trouble shooting procedures
    - c. starter motor overhaul
  - 4. Precautions/safety

### III. Brakes

- A. Introduction
  - 1. Safety
    - a. vehicle
    - b. working
    - c. asbestos hazard
  - 2. Precision equipment
  - 3. Heat machine/friction
    - a. limits
    - b. fade
- B. Hydraulic principles
  - 1. Liquids
    - a. force
    - b. pressure
    - c. motion

2. Pascal's Law
  3. Application
  4. Valves-balanced brake
    - a. metering valves
    - b. proportioning valve
  5. Brake fluid
    - a. precautions
    - b. temperature
  6. Master cylinder
    - a. operation
    - b. residual check valve
    - c. inspection
    - d. pedal play
  7. Wheel cylinders
    - a. operation
    - b. parts/inspection
    - c. service
  8. Metal brake lines
  9. Brake hoses
  10. Brake bleeding
- C. Drum Brakes
1. Bendix hydraulic brake
    - a. shoes
    - b. hardware
    - c. operation
      1. self-energizing
      2. self-adjusting
    - d. service/specification
      1. inspection
      2. service
    - e. drums
      1. measuring/inspection
      2. machining
- D. Design variations
1. Manual/power
  2. Other shoe designs
- E. Manual brake-parking
1. Operation
  2. Adjustment
- F. Disc brake
1. Introduction
  2. Operation
    - a. single piston caliper
    - b. multi piston caliper
    - c. pads
    - d. master cylinder action
    - e. self-adjusting
    - f. fluid



3. Service
  - a. inspection/service
  - b. rotor
    1. inspection/measuring
    2. machining
  - c. cautions

IV. Alignment/Front Suspension/Steering

- A. Steering/suspension types
  1. Independent conventional
  2. MacPherson strut
  3. Solid type/4 wheel drive
- B. Steering linkage
  1. Parallelogram
  2. Rack and pinion
- C. Steering gears
  1. Manual
  2. Power
- D. Suspension
  1. Spring
    - a. leafs
    - b. coils
    - c. Torsion bar
  2. Air
  3. Dampening devices
    - a. purpose
    - b. types
      1. hydraulic type shock
      2. others
- E. Inspection/service
  1. Safety
  2. Tools
  3. Procedures
  4. Front end problems
  5. Correction of problems
- F. Alignment
  1. Introduction - tire wear
    - a. steering geometry
    - b. suspension geometry
  2. Wheel alignment factors
    - a. caster
    - b. camber
    - c. toe in
    - d. steering axis inclination
    - e. toe in, toe out on turns
  3. Procedure
    - a. inspection
    - b. equipment set-up
    - c. service specifications
    - d. order of performance
    - e. safety

V. Multi cylinder Precision Measurement

A. Micrometer

1. Measuring crankshaft crank journal
  - a. manufacturer's specs.
  - b. out of round
  - c. taper
  - d. bearing selection/rejection
2. Measuring main bearing journals
  - a. manufacturer's specs.
  - b. out of round
  - c. taper
  - d. bearing selection/rejection

B. Dial indicator

1. Measuring crankshaft end play
2. Measuring flywheel run out
3. Manufacturer's specs.

C. Cylinder bore gauge/inside micrometer

1. Measuring cylinder bore
  - a. manufacturer's specs.
  - b. taper
  - c. out of round

D. Precision outside caliper

1. Measuring camshaft journals
2. Manufacturer's specs.

VI. Power Train

A. Manual transmission

1. Introduction
  - a. gears
    1. purpose
    2. types
  - b. speeds
  - c. ratios (related math skills)
2. Components/operation
3. Service
  - a. fluid
    1. checks
    2. leaks
  - b. linkage
    1. binding
    2. adjustments
  - c. noise

B. Clutches

1. Introduction
  - a. pressure
  - b. friction
  - c. slippage
  - d. safety

- 2. Parts
  - a. flywheel
  - b. pressure plate
  - c. clutch disc
  - d. throw out bearing
  - e. pilot bearing/bushing
- 3. Activating devices
  - a. mechanical
  - b. hydraulic clutch
    - 1. master cylinder
    - 2. slave cylinder
- 4. Service
  - a. adjustment
  - b. replacement service
  - c. safety
    - 1. asbestos
    - 2. handling
- C. Drive Shaft/universals
  - 1. Purpose
  - 2. Universal/velocity joint differences
  - 3. Service
    - a. inspection
    - b. R/R drive-shaft
    - c. R/R universal
- D. Differential/axle
  - 1. Introduction
    - a. purpose
    - b. variations
    - c. ratios
  - 2. Parts
    - a. drive pinion
    - b. ring gear
    - c. case
    - d. pinion shaft
    - e. pinion gear
    - f. side gears
    - g. thrust washers
    - h. bearings
    - i. gaskets/seals
  - 3. Service
    - a. fluid checks
    - b. drive noises
    - c. visual inspection
    - d. R/R service
      - 1. set-up checks
      - 2. seal replacement
      - 3. safety

4. Axle service
  - a. stud replacement
  - b. seals
  - c. bearings
  - d. axle R/R
  - e. safety

## VII. Fuel/Carburetor/Injection

### A. Carburetion

1. Theory of Operation
  - a. vaporization
  - b. venturi effect
  - c. throttle valve
  - d. air-fuel ratios
2. Carburetor design
  - a. fixed venturi
  - b. variable venturi
3. Carburetor systems
  - a. float
  - b. idle/part throttle
  - c. main metering
  - d. power
  - e. accelerator pump
  - f. choke
4. Special carburetor controls
5. Two and four barrel carburetors
6. Service
  - a. performing a fuel pump test
  - b. float level adjustments
  - c. idle and linkage adjustments
  - d. adjusting CO and HC levels for inspection
  - e. carburetor overhaul
7. Safety

### B. Fuel Injection

1. Types
  - a. throttle body
  - b. port injection
2. Control
  - a. mechanical
    1. air flow sensors
    2. fuel distributor
  - b. electronic
    1. engine sensors
    2. electronic control module (microprocessor)
3. Spray patterns
  - a. continuous
  - b. intermittent
  - c. operating pressure

4. Fuel delivery system
  - a. pump
  - b. accumulator/regulator
  - c. filter
5. Service
  - a. fuel pressure test
  - b. pulse width test
  - c. filter replacement
  - d. control switches
  - e. leak checks (fuel or air)
  - f. adjustments
6. Safety
- C. Turbo-charging
  1. Purpose
  2. Parts
    - a. turbine/compressor
    - b. wastegate
  3. Operation
    - a. boost
    - b. detonation

#### VIII. Accessories

- A. Circuits
  1. Series
  2. Parallel
  3. Tracing
    - a. color coding
    - b. continuity
- B. Testing
  1. Open
  2. Shorts
  3. Resistance
  4. Voltage
  5. Amperage
- C. Vacuum
  1. Switches
  2. Valves
- D. Lights
- E. Wipers
- F. Radio
- G. Heater
- H. Power windows
- I. Solenoids
- J. Horn
- K. Power lock
- L. Air Conditioning
  1. Fundamentals
    - a. evaporation
      1. heat transfer
      2. boiling point

- b. refrigerator
- c. high and low pressure sections
- 2. Components
  - a. evaporator
  - b. condenser
  - c. compressor
    - 1. cycling and non-cycling
    - 2. clutch
  - d. accumulator/receiver drier
  - e. switches or orifice tubes
- 3. Testing
  - a. performance testing
    - 1. high discharge temperature
    - 2. ice information
    - 3. compressor noise
    - 4. pressure gauge readings high or low
- 4. Service
  - a. discharge/evacuation
  - b. charging
  - c. leak detection
  - d. compressor/clutch service
  - e. component replacement
- 5. Safety

## IX. Careers

### A. The Automotive Industry

- 1. Manufacturing
  - a. designers
  - b. engineers
  - c. parts production
- 2. Sales
  - a. dealership-vehicle salesman
  - b. parts
- 3. Service
  - a. general mechanic
  - b. specialty mechanic - trans., brakes, exhaust, etc.
  - c. shop foreman
  - d. service manager
  - e. service station owner/mechanic
- 4. Others
  - a. insurance adjuster/claims
  - b. instructor
  - c. auto body

### B. Job requirements

- 1. Education - college and trade schools
- 2. Certification (NIASE)
- 3. Need to specialize
- 4. Benefits
- 5. Drawbacks

- 6. Tools
- 7. Advancement
- C. Applying for a job
  - 1. the application
  - 2. the interview
- D. Job keeping skills

### Suggested Teaching Procedures

1. Information will be presented to the students through various methods to assure optimum learning achievement on all levels of student aptitude. This information can be presented through such methods as lecture, demonstrations, text assignments, guest speakers, project assignments, hand outs, and field trips.
2. Audio-visual aids will be employed where needed to reinforce and clarify the teacher presented topics.
3. Appropriate career information will be presented at various times throughout the duration of the course.
4. Class projects and assignments should be interwoven with lecture material.
5. The relationship of classroom activities and outside work experiences should be stressed.
6. Instructor will encourage the development of good work habits through emphasis on interpersonal relations, punctuality, attendance, and cooperation.
7. Classes may be divided into small groups of students when working in the lab area and may be assigned to different projects or repairs.
8. The importance of doing a "professional" repair when doing shop repairs or projects will be stressed throughout the year.
9. Students will be encourage to develop pride in their work.
10. Classroom activities May include simulated and/or "live" testing and repair of vehicles.



## Time-line Periods

I. Introduction	8
II. Electrical/Electronics	34
III. Brakes	25
IV. Alignment/Front Suspension	23
V. Multi-cylinder Precision Measurement	20
VI. Power Train	15
VII. Fuel/Carburetor/Injection	30
VIII. Accessories	20
IX. Careers	5

Total Periods - 180

## Suggested Materials and Equipment

This course of study is not based on any one text. New text and materials may be evaluated and selected as they become available.

The following is a list of suggested materials and equipment which might be used for Automotive II. The supervisor can advise a teacher of the availability of materials in a particular school.

### A. Recommended Text

Crouse, William H. and Anglin, Donald L. Automotive Mechanics. New York: McGraw Hill, 1985, 9<sup>th</sup> edition.

Stokel, Martin W. and Stokel, Martin T. Auto Mechanics Fundamentals. Goodheart Wilcox, 1982.

Stokel, Martin W. Auto Service and Repair. Goodheart Wilcox, 1984.

### Workbooks

Stokel, Martin and Duffy, James. Auto Mechanics Fundamentals. Goodheart Wilcox, 1982.

### B. Supplemental Materials

Bergwall Productions  
PO Box 238  
Garden City, NY 1153

### Filmstrips/Cassette series

1. Auto Precision Tools
2. Automotive Shop Safety
3. Basic Electricity DC
4. Buying a Used Car
5. Cooling Systems Explained
6. Front End Explained
7. GMX Body Brakes
8. How to do a Major Engine Tune-up
9. Internal Combustion Engine
10. Introduction to Auto Shop Safety
11. Measuring Tools Explained
12. Outboard Marine Engine
13. Small Engines Explained
14. Standard Transmissions

15. The Front End Explained
16. The GM MacPherson Strut System
17. The Hydraulic Brake System Explained
18. The Ignition System Explained

Chrysler Master Technician Series  
Chrysler Corporation Training Center  
Service Development and Training Department  
PO Box 478  
Detroit, Michigan 48232

#### Filmstrip/Phono

1. Alternator and Regulator
2. Brake Hydraulics
3. Carburetor Fundamentals
4. Controlling Engine Temperature
5. Double Barreled Carburetor Facts
6. Drum Brake Service Highlights
7. Finer Points of 4 Barrel Carburetor
8. Floating Caliper Disc Brake
9. Fuel, Lubricants, and Fluids
10. Heated Air Intake and Vapor Saver
11. Let's Keep It Clean
12. Power Steering
13. Servicing the 81/4" Rear Differential
14. Shock Absorber Facts
15. Steering Column and Shift Linkage

Briggs and Stratton  
Milwaukee, Wis. 53201

#### Slide Series

1. Disassembly, Inspection, Re-assembly Explained
2. Changing Times

#### Filmstrip/Cassette

1. So You Want Wheels

DCA Educational Products  
424 Valley Road  
Warrington, PA 18976

#### Overheads

1. Auto Electrical System
2. Auto Engine

3. Brakes
4. Fuel System
5. Small Gas Engines
6. Understanding the Automobile

Echlin Manufacturing Company  
Branford, Connecticut

#### Slide Series

1. Technical Ignition Course

Encyclopedia Britannica

#### Filmstrip

1. Auto Mechanics/Diagnostic Testing

General Motors Corporation  
30007 Van Dyke Avenue  
Warren, Michigan 48090

#### Slide/Cassette

1. High Energy Ignition System
2. Passenger Car Integral Charging System

Hoffman Occupational Learning Center

#### Filmstrip

1. Automotive Transmissions Repair, Manual and Automatic

McGraw Hill  
PO Box 401  
Hightstown, NJ 08520

#### 8mm Film Loop

1. Automotive Mechanics Engine Rebuilding Set #1 and #2

New Jersey Department of Education  
Division of Educational Education

1. Basic Ignition and the Sun Scope

Prentice Hall  
150 White Plains Road  
Tarrytown, NY 10591

1. Basic Auto Service
2. The GM MacPherson Strut System
3. The GM X Body Front Drive Axle Service

#### C. References

- Blanchard, Harold and Retchen, Ralph. Auto Engines and Electrical Systems. Motor Pub., New York, 1973.
- Chilton, Manuals. Current and prior editions. Chilton Book Co., Randnor, PA.
- DeKryger/Kovacik/Bono. Auto Mechanics Theory and Service. South Western Publishing Co., Cincinnati, 1986.
- Elder, Thomas and Smith, Wayne. Automotive Electronic Management Systems. NJ Department of Vocational Education, June 1985.
- Erjavec, Jack. Engine Diagnostics and Tune-up. Prentice Hall, Inc., Tarrytown, NY, 1986.
- Ford Motor Company. Ford Automobile Mechanic Training Program Curriculum Outline. 1985.
- Mitchell Information Services, Inc. Mitchell Auto Mechanics. Prentice Hall, Inc., Tarrytown, NY, 1986.
- Mitchell Information Service, Inc.  
San Diego, California
1. Electronic Fuel Injection, 1985
  2. Computerized Engine Controls, 1982-84
  3. Automotive Emission Control, 1985
  4. Electronic Ignition, 1984.
  5. Imported Cars and Trucks Service and Repair
- Mitchell Manuals, Inc., Current and prior editions. San Diego, California.
- Motor's Manual, Current and prior editions. Motor Publ., New York, NY.
- Motor Vehicle Manufacturers Association of the United States, Inc. Standards for Vocational Automotive Service Instructors. 1979.

Rhode Island Department of Vocational/Technical Education.  
Auto Mechanics: A Competency Based Curriculum Guide.

Richards, Roger and Hunter, Wallace. Automotive Mechanics.  
Vocational Consortium of States. 1976.

Schuly, Erick. Diesel Mechanics. McGraw Hill, 1977.

#### D. Equipment List

1. Valve grinder
2. Brake shop
3. Engine analyzer
4. Infrared combustion efficiency tester
5. Distributor tester
6. Wheel alignment
7. Generator/regulator test
8. Test engines
9. Bubble balance
10. Tire changer/Pneumatic
11. Lubricator
12. Lift
13. Chain hoist
14. Parts washer
15. Air compressor and hose
16. Drill press
17. Grinder
18. Headlight tester
19. Hand drill
20. Welding/gas and arc
21. Engine stands
22. Drain oil drum
23. Creeper
24. Safety stands
25. Floor jack
26. Twin saddle jack
27. Tachometer
28. Dwell meter
29. Vacuum gauge
30. Compression tester
31. Brake bleeder
32. Air impact tools
33. Inside and outside micrometers
34. Tap and die set - UN and metric
35. Automatic transmission pressure tester
36. Automatic transmission vise
37. Multi-meter, volts, current, resistance
38. Battery tester/charger
39. Suspension spring compressor

40. Air conditioning manifold gauge set
41. Air conditioning vacuum pump
42. Air conditioning compression tools
43. Computerize engine analyzer
44. Computerized wheel balancer
45. Sand blaster
46. Steam cleaner
47. Post jack
48. Hydraulic press
49. Transmission jack
50. Spin balancer
51. Carburetor cleaning tank
52. Outboard motor tank