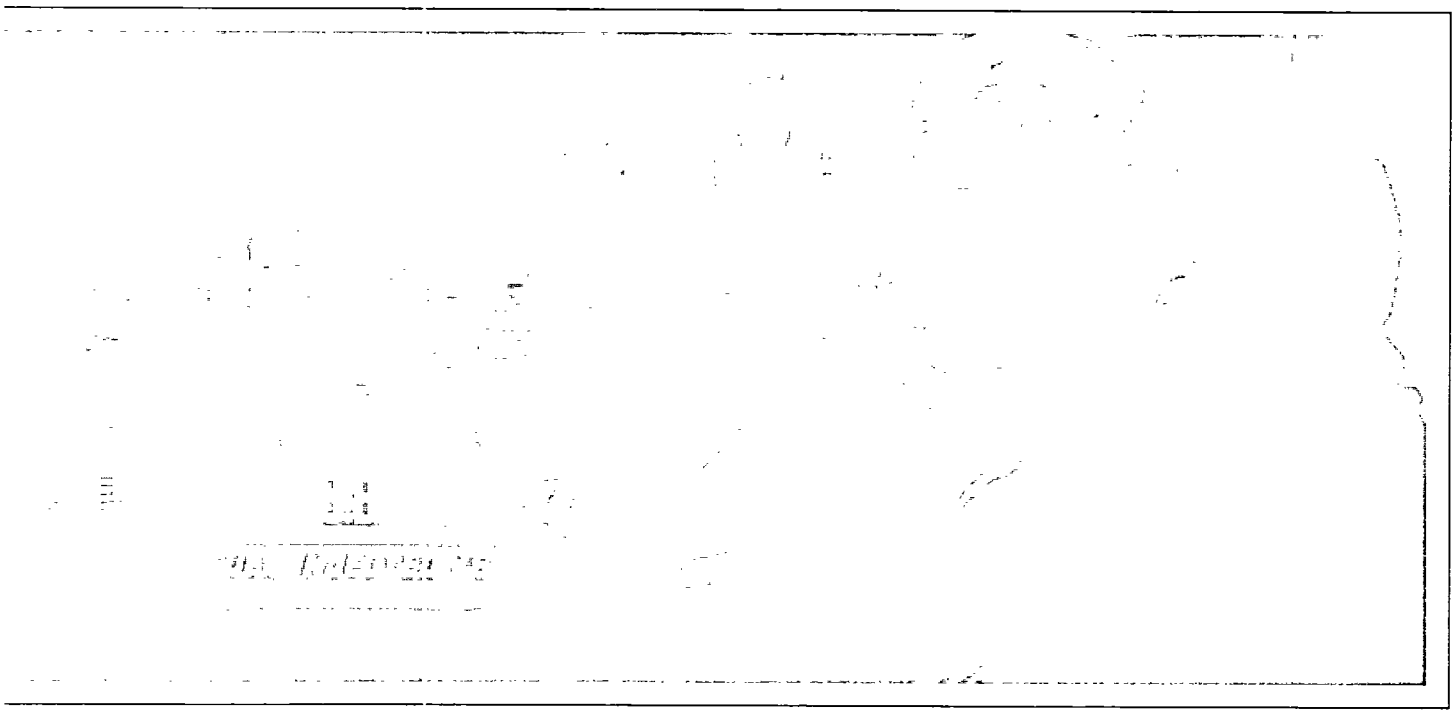
TECHNOLOGY EDUCATION
AUTOMOTIVE TECHNOLOGY

GRADES 9-12
ELECTIVE



The University of the State of New York
The State Education Department
Bureau of Home Economics
and Technology Education Programs
Division of Occupational Education
Albany, New York 12234

THE UNIVERSITY OF THE STATE OF NEW YORK

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Overview and Rationale

This course and specified focused sequence will provide interested Regents and non-Regents students with a broad base of technical knowledge and skill. It also will develop in students limited entry level skills and appropriate work place attitudes for specific areas in the auto service industry that technology is dramatically changing.

Students wishing to develop more advanced skills in these areas will be informed of the possibilities for additional training which is available from BOCES and local community colleges.

This one-unit course of instruction has been designed to be offered as two 1/2-unit instructional components to afford local school districts greater flexibility in meeting the scheduling needs of individual students.

It is hoped that school districts will articulate this focused sequence with local area community colleges and establish procedures to facilitate the granting of advanced placement.

USE IN SEQUENCE: Elective course

This course is one of the New York State approved electives in Technology Education. It is one of several electives courses designed to give students a firm but broad exploration of the technical world in which they live.

Students completing a high school sequence in Technology Education must take a total of 1-3 units of elective course work to fulfill the "elective" portion of their sequence requirement. This course may also be taken by any student as an elective. If the instructor uses this syllabus as a guide for instruction, students may be granted Regents credit for the experience.

Several courses within Technology Education offerings can be offered on a 1/2-unit or 1-unit basis. Course work earning 1/2-unit must comprise a minimum of 54 hours of instruction and course work earning 1-unit must comprise a minimum of 108 hours of instructional time.

Students with Disabilities

The Board of Regents, through the part 100 Regulations of the Commissioner, the Action Plan, and The Compact for Learning, has made a strong commitment to integrating the education of students with disabilities into the total school program. According to Section 100.2(s) of the Regulations of the Commissioner of Education, "Each student with a handicapping condition as such term is defined in Section 200.1(ii) of this Chapter, shall have access to the full range of programs and services set forth in this Part to the extent that such programs and services are appropriate to such student's special educational needs." Districts must have policies and procedures in place to make sure that students with disabilities have equal opportunities to access diploma credits, courses, and requirements.

The majority of students with disabilities have the intellectual potential to master the curricula content requirements for a high school diploma. Most students who require special education attend regular education classes in conjunction with specialized instruction and/or related services. These students must attain the same academic standards as their nondisabled peers to meet graduation requirements, and, therefore, must receive instruction in the same content areas, at all grade levels. This will ensure that they have the same informational base necessary to pass statewide testing programs and meet diploma requirements.

Teachers certified in the subject area should become aware of the needs of students with disabilities who are participating in their classes. Instructional techniques and materials must be modified to the extent appropriate to provide students with disabilities the opportunity to meet diploma requirements. Information or assistance is available through special education teachers, administrators, the Committee on Special Education (CSE) or student's Individualized Education Program (IEP).

Strategies for Modifying Instructional Techniques and Materials

1. Students with disabilities may use alternative testing techniques. The needed testing modification must be identified in the student's Individualized Education Program (IEP). Both special and regular education teachers need to work in close cooperation so that the testing modifications can be used consistently throughout the student's program.

2. Identify, define and pre-teach key vocabulary. Many terms in this syllabus are specific and some students with disabilities will need continuous reinforcement to learn them. It would be helpful to provide a list of these key words to the special education teacher in order to provide additional reinforcement in the special educational setting.

3. Assign a partner for the duration of a unit to a student as an additional resource to facilitate clarification of daily assignments, timelines for assignments, and access to daily class notes.

4. When assigning long-term projects or reports, provide a timeline with benchmarks as indicators for completion of major sections. Students who have difficulty with organizational skills and time sequence may need to see completion of sections to maintain the organization of a lengthy project or report.

Infusing Awareness of Persons with Disabilities Through Curriculum

In keeping with the concept of integration, the following subgoal of the Action plan was established.

In all subject areas, revisions in the syllabi will include materials and activities related to generic subgoals such as problem solving, reasoning skills, speaking, capacity to search for information, the use of libraries and increasing student awareness of and information about the disabled.

The purpose of this subgoal is to ensure that appropriate activities and materials are available to increase student awareness of disabilities.

This curriculum, by design, includes information, activities, and materials regarding persons with disabilities. Teachers are encouraged to include other examples as may be appropriate to their classroom or the situation at hand.

STUDENT LEADERSHIP SKILLS

Development of leadership skills is an integral Part of occupational education in New York State. The New York State Education Department states that, "Each education agency should provide to every student the opportunity to participate in student leadership development activities. All occupational education students should be provided the opportunity to participate in the educational activities of the student organization(s) which most directly relate(s) to their chosen educational program."

Leadership skills should be incorporated in the New York State occupational education curricula to assist students to become better citizens with positive qualities and attitudes. Each individual should develop skills in communications, decision making/problem solving, human relations, management, and motivational techniques.

Leadership skills may be incorporated into the curricula as competencies (Performance Objectives) to be developed by every student or included within the Suggested Instructional Strategies. Teachers providing instruction through occupational educational curricula should familiarize themselves with the competencies. Assistance may be requested from the State advisor of the occupational student organization related to the program area.

Students who elect to become active members of one of the student leadership organizations chartered by the New York State Education Department have the advantage of the practical forum to practice leadership skills in an action oriented format and have the potential for recognition of their achievements at the local, State, and national level.

Syllabus Objectives

Through the implementation of this syllabus, the student will be able to:

- Demonstrate an understanding of automotive technology and its place in our society.
- Describe careers in automotive technology and their requirements.
- Perform a wide variety of pre-specialization activities with materials, tools, equipment and procedures common to the automotive area.
- Pursue the area of automotive technology in greater depth as he or she assesses personal interests, abilities, potentials and limitations.

SYLLABUS OUTLINE
Table of Contents

AUTOMOTIVE TECHNOLOGY

		Estimated Learning Time
I.	**Module: Introduction**	**10 hours**
	Topics:	
	A. Careers	2 hours
	B. Tools	2 hours
	C. Work habits	2 hours
	D. Safety	2 hours
	E. References	2 hours
II.	**Module: Basic Electricity/Electronics**	**9 hours**
	Topics:	
	A. Ohms Law	2 hours
	B. DC Motors	2 hours
	C. Meters	2 hours
	D. Semiconductors	1 hour
	E. Introduction to Computers	2 hours
III.	**Module: Automotive Systems**	**72 hours**
	Topics:	
	A. Engine Theory	4 hours
	B. Electrical Systems	4 hours
	C. Ignition Systems	6 hours
	D. Charging Systems/Starting Systems	4 hours
	E. Fuel Systems	7 hours
	F. Computer/Emission Systems	6 hours
	G. Engine Performance/Diagnosis	7 hours
	H. Lubrication Systems	4 hours
	I. Cooling, Heating/AC Systems	3 hours
	J. Brake Systems	6 hours
	K. Steering/Suspension/Tires/Alignment	8 hours
	L. Drive Trains	7 hours
	M. Vehicle Surfaces	5 hours

IV.	**Module: Environmental Impacts**	**4 hours**
	Topics:	
	A. Hazardous/Toxic Wastes and Controls	1 hour
	B. Air Quality	1 hour
	C. New York State "Right to Know"	2 hours
V.	**Module: Work Place Communications**	**8 hours**
	Topics:	
	A. Customer Relations	2 hours
	B. Parts and Inventory Control	1 hour
	C. Service Records	2 hours
	D. Management Skills	1 hour
	E. Billing	1 hour
	F. Marketing	1 hour
VI.	**Module: Consumer Issues**	**6 hours**
	Topics:	
	A. Purchasing	2 hours
	B. Repair Facilities	1 hour
	C. Maintenance and Prevention Records	1 hour
	D. Car Insurance	1 hour
	E. New York State Inspection	1 hour

Total Estimated Learning Time: 108 Hours

Performance Objectives

The performance objectives of the syllabus are intended to clearly present what students are expected to know, do and be like, following instruction in a given topic. The knowledge (K), skills (S) and attitudes (A) that students should acquire are identified for each topic, under "competencies to be developed".

Syllabus Component

AUTOMOTIVE TECHNOLOGY

I. Module: Introduction

A. Topic: Careers

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be knowledgeable in careers associated with the automobile.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Classify as to professional, technical, skilled, semi-skilled or unskilled. (K)
  b. Identify the type of training and physical characteristics needed to perform the duties. (K)
  c. Describe conditions under which the duties will be performed. (K)
  d. Evaluate the future of each career. (K)

- Suggested Instructional Strategies:

  1. Set up "shadowing" experiences for students in selected occupational areas.

  2. Have students take independent field trips to observe occupations and report their findings to the class.

  3. Have students make a collection of classified ads dealing with automotive careers.

B. Topic: Tools

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be knowledgeable about automotive tools and related accurate measurement instruments.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify common hand tools associated with the automobile. (K)
  b. Operate power tools commonly used on an automobile. (K) S)
  c. Measure with an accuracy of .001" selected automobile components. (K) (S)

- Suggested Instructional Strategies:

  1. Hand out activity sheets depicting automotive tools. Have students label and define the proper tools for specific tasks.

  2. Have students choose the correct tool for specific task.

  3. Have students measure selected components using micrometers, dial indicators, and verniers.

C. Topic: **Work Habits**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will work in a safe, orderly and cooperative manner.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Complete a questionnaire regarding safe, orderly and cooperative working habits. (K) (A)
  b. Perform tasks in a safe, orderly and cooperative manner. (A)

- Suggested Instructional Strategies:

  1. Demonstrate an orderly placement of tools and components during a service operation.

  2. Encourage students to work in teams.

D. Topic: **Safety**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will know the location of and procedures for the use of various safety and emergency equipment (e.g., fire alarm, power kill switch, fire blanket, fire extinguishers, eyewash station and emergency exits).

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Satisfactorily complete a safety quiz that identifies dangerous elements and the corresponding safety precautions in the automotive laboratory. (K) (A)
  b. Recognize a class A, B or C fire extinguisher. (K)
  c. Demonstrate the safe storage of flammables and chemicals.
  d. Recognize hazardous situations in the automotive laboratory and report them to the instructor. (A)

- Suggested Instructional Strategies:

  1. Have students complete and sign a safety quiz.

  2. Have students view a film on safety.

  3. Have students prepare a bulletin board on safety.

E. Topic: **References**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will successfully use automotive reference materials.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Collect information using written, video, audio, and other means as needed. (K) (S)
  b. Use references to locate information. (K)
  c. Use a computer to gain information by loading a program, manipulating data and storing information. (S) (K)

- Suggested Instructional Strategies:

  1. As an introduction, have students complete an activity sheet that requires the use of all available references (e.g., service manuals, texts, computer programs, microfiche, CD ROM, estimating guides, service records).

  2. With each topic, have students complete activity sheets that require the use of references (e.g., cost estimating, parts/inventory, specifications records).

II. Module: Basic Electricity/Electronics

A. Topic: **Ohms Law**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will use Ohms Law to determine voltage, current and resistance in circuits.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Understand the theory and principles of basic electricity/electronics. (K)
  b. Calculate voltage drops in a circuit. (K) (S)
  c. Calculate current drops in a circuit. (K) (S)
  d. Calculate resistance totals in a circuit. (K) (S)

- Suggested Instructional Strategies:

  1. Have students calculate values using prepared activity sheets.

  2. Demonstrate the effects on voltage and current when resistances are placed in series and parallel circuits.

B. Topic: **DC Motors**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will understand the theory and principles of magnetism and DC electric motors.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Demonstrate the principles of magnetism using permanent and electromagnets. (K)
  b. Operate a DC electric motor and be able to describe the applied scientific principles. (S) (K)

- Suggested Instructional Strategies:

  1. Using permanent and electromagnets, have students demonstrate magnetic theory.

  2. Using a DC electric motor, have students demonstrate the principles of operation.

C. Topic: **Meters**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will operate multimeters to measure values related to electricity/electronics.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Use multimeters to measure voltage, current and resistance in circuits. (K) (S)
  b. Understand and appreciate the proper use and care of delicate measuring instruments. (K) (A)

- Suggested Instructional Strategies:

  1. Have students measure the resistance of several selected automotive components.
  2. Have students measure voltage and current in given circuits.

D. Topic: **Semiconductors**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify common automotive semiconductors.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify the use and application of various semiconductors in automotive applications. (K)
  b. Describe the theory of semiconductor materials. (K)

- Suggested Instructional Strategies:

  1. Have students complete an activity sheet that requires them to identify and describe various semiconductors.

  2. Have students place various semiconductors in a circuit and measure and describe the results.

E. Topic: **Introduction to Computers**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will understand the basic operation of computers.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Describe the input, process and feedback of a computer system. (K)

- Suggested Instructional Strategies:

  1. Have the students complete a flow chart pictorial of a computer system.

  2. Have the students describe and identify various computer components.

III. Module: Automotive Systems

A. Topic: **Engine Theory**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will understand the theory and operation of an internal combustion engine.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify the various components of an automobile engine. (K)
  b. Describe the theory and operation of an internal combustion engine. (K)

- Suggested Instructional Strategies:

  1. Have students obtain general engine specifications from a reference manual.

  2. Have students complete an activity sheet which asks them to identify all the major components of an automobile engine.

  3. Have students view the film "ABC's of the Automobile Engine" from General Motors.

B. Topic: **Electrical Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to read electrical circuit diagrams, identify various electrical components and connect and diagnose their operation in a circuit.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Troubleshoot and correct inoperable automotive circuits using circuit diagrams and test equipment. (S)
  b. Use meters and test light to detect faults in automotive circuits. (S)
  c. Connect various automotive electrical components in a circuit and diagnose their operation.

- Suggested Instructional Strategies:

  1. Have students connect various automotive electrical components into a circuit following a given circuit diagram.

  2. Have students test components for proper operation.

  3. Have students use a multimeter and test light to trace and troubleshoot circuits.

C. Topic: **Ignition Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify the various components of an automotive ignition system and perform the various adjustments and maintenance procedures that are associated with a tune up.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify the various components of an ignition system. (K)
  b. Operate an engine and/or ignition simulator and demonstrate proper tune up procedures. (K) (S)
  c. Use hand tools, timing light, reference manuals, gapping tools, etc., to perform a tune up and maintenance procedures. (K)

- Suggested Instructional Strategies:

  1. Have students adjust a simulator to a given car's ignition specifications.

  2. Have students view the film "ABC's of High Energy Ignition" from General Motors.

  3. Have students adjust an operating engine to the proper specifications.

  4. Have students complete activity sheets on specifications, cost estimating and maintenance records.

D. Topic: **Charging Systems/Starting Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify the various components and explain the operation associated with each system.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify and describe the components and operation of an automobile starter. (K)
  b. Identify and describe the components and operation of an automobile alternator. (K)
  c. Disassemble and reassemble an automotive starter and alternator. (K) (S)
  d. Test the components for proper operation. (K) (S)

- Suggested Instructional Strategies:

  1. Have students disassemble and reassemble starters and alternators, then test components and assemblies for proper operation.

  2. Have students test an alternator on an automobile for voltage output.

  3. Have students perform a cranking voltage test on a vehicle.

E. Topic: **Fuel Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify and describe the operation of the various components of the fuel system.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Describe Bernoulli's principle. (K)
  b. Identify and describe the operation of the various parts of an automotive carburetor. (K)
  c. Identify and describe the operation of an automotive fuel injection system. (K)

- Suggested Instructional Strategies:

  1. Have students disassemble a carburetor and describe the function and related parts.

  2. Have students disassemble, describe and identify a fuel injection system.

F. Topic: **Computer/Emission Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify the various automobile emissions and describe the function of each control system.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Name the emissions from an automobile engines exhaust. (K)
  b. Identify the control systems for each type of emission. (K)
  c. Service and inspect the various emission control components. (S)
  d. Describe the function of the computer in controlling performance and exhaust emissions. (K)

- Suggested Instructional Strategies:

  1. Have students service and inspect emission control components.

  2. Have students view the film "ABC's of the Catalytic Converter" from General Motors.

G. Topic: **Engine Performance/Diagnosis**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to use the various types of analyzing equipment to diagnose engine problems and adjust for optimum performance.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Use an automotive oscilloscope to diagnose an engine. (K) (S)
  b. Analyze exhaust gas emissions from a vehicle to determine emission control and computer sensor conditions. (K) (S)
  c. Make effective decisions on replacement and/or adjustment of ignition, fuel, emission and computer components. (K) (S)

- Suggested Instructional Strategies:

  1. Have students attach an automotive oscilloscope to an engine.

  2. Have students use a hand-held monitor to examine the computer and related sensors.

  3. Have students use troubleshooting charts in reference manuals to determine faults, if any.

H. Topic: **Lubrication Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will understand the importance and function of lubrication.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify components of a lubrication system. (K)
  b. Use lubricants on various automobile components. (S)
  c. Interpret codes on oil containers for proper selection. (K)

- Suggested Instructional Strategies:

  1. Have students view a film from one of the oil companies.

  2. Have students perform an oil change and lubrication on a car.

  3. Have students properly dispose of the used oil.

I. Topic: **Cooling, Heating/AC Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify and describe the function of the components associated with cooling, heating and air conditioning.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Determine the correct operation of system components. (S)
  b. Identify the various components associated with each system. (K)
  c. Perform routine maintenance on a cooling/heating system. (S)

- Suggested Instructional Strategies:

  1. Have students flush, clean, and refill a cooling/heating system and then test for freezing point.

  2. Have students check the opening temperatures of thermostats.

  3. On a pictorial diagram, have the students trace the flow and label the parts of a typical cooling, heating/AC system.

  4. Have students calculate the boiling and freezing points of a cooling/heating system.

J. Topic: **Brake Systems**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify the components of an automobile brake system and perform routine maintenance and service checks.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify the components of both disc and drum systems. (K)
  b. Perform a service check to inspect for wear and proper operation. (S)

- Suggested Instructional Strategies:

  1. Have students remove and replace disc brake pads.

  2. Have students remove, replace and adjust drum brake shoes.

  3. Have students inspect fluid level, lines and master cylinder.

  4. Have students complete an activity sheet on troubleshooting and cost estimating.

  5. Arrange for a demonstration of a car with hand brakes. Have students inspect how it is the same/different.

K. Topic: **Steering/Suspension/Tires/Alignment**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to perform a safety inspection on the related components.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify the components associated with steering and suspension. (K)
  b. Analyze wear characteristics and determine tire condition. (S)
  c. Inspect a vehicle for worn steering/suspension parts. (S)
  d. Demonstrate knowledge of wheel alignment procedures. (K) (S)
  e. Demonstrate the ability to mount, balance and rotate tires. (K) (S)

- Suggested Instructional Strategies:

  1. Have students view the film "ABC's of the Automobile Chassis" from General Motors.

  2. Have students use front end simulator to perform wheel alignment and safety inspections.

  3. Have students complete a cost estimating activity sheet pertaining to the unit.

L. Topic: **Drive Trains**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify the major components and perform service checks on drive trains.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify and explain the function of the major components associated with drive trains. (K)
  b. Calculate gear ratios and understand effect on speed and power. (S)
  c. Use a troubleshooting chart to identify problems and their probable causes. (K) (S)

- Suggested Instructional Strategies:

  1. Have students disassemble, reassemble and inspect differentials, automatic and manual transmissions.

  2. Have students label major components of various power trains on pictorial drawings.

  3. Have students complete activity sheets relating to troubleshooting and cost estimating.

M. Topic: **Vehicle Surfaces**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to perform the various procedures associated with paint touch up and maintenance.

- Competencies to be Developed:
  After studying this topic, the student will be able to,
  a. Recognize surface blemishes. (K)
  b. Perform maintenance operations. (S)

- Suggested Instructional Strategies:

  1. Given a 12"x12" piece of sheet steel have students use the appropriate materials, (see 3) to apply a finish coat of paint.

  2. Have students use appropriate materials, to repair and refinish the panel (e.g. metal etch, prep sol, body filler, primer/surfacer, spot putty, paint, clear coat, rubbing compound, and wax).

IV. Module: Environmental Impacts

A. Topic: **Hazardous/Toxic Wastes and Controls**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will have an awareness of, and a sensitivity to, the environmental impacts caused by the auto industry.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Use proper procedures for the handling and disposal of hazardous/toxic wastes associated with the automobile (e.g., oil, paints, solvents, battery acid). (K) (S)
  b. Identify common hazardous/toxic wastes associated with the auto industry. (K)
  c. Understand the environmental impact of hazardous/toxic wastes. (A)

- Suggested Instructional Strategies:

  1. In conjunction with the Social Studies and English departments have students prepare a report on environmental impacts.

  2. Have students participate in recycling of all waste products in the automotive laboratory.

  3. Have students visit a recycling or reclaiming center.

B. Topic: **Air Quality**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to identify the environmental impacts of auto exhaust emissions impacts on air quality.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify common airborne pollutants associated with the automobile. (K)
  b. Understand the environmental impact of airborne pollutants. (A)
  c. Use proper procedures to ensure safe air quality in the automotive laboratory. (K) (A)

- Suggested Instructional Strategies:

  1. Have students work in conjunction with other curriculums to gain knowledge (e.g., research, write reports, give presentations, collect data, compute conclusions, prepare audio/video communications).

  2. Have students use HC/CO detecting equipment to analyze exhaust emissions from an automobile.

  3. Have students use proper procedures and equipment to ensure safe air quality in the automotive laboratory (e.g., dust collectors, exhaust fans, engine emissions, paint booths, respirators, asbestos disposal).

C. Topic: **New York State "Right to Know"**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be aware of the New York State law, "Right to Know."

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Read and interpret Material Safety Data Sheets. (K) (S)
  b. Be aware of the hazards and environmental implications associated with the various materials in the automotive laboratory. (K) (A)

- Suggested Instructional Strategies:

  1. Have students complete an activity sheet designed to provide knowledge about Material Safety Data Sheets.

  2. Have students work in conjunction with other curriculums to gain knowledge (e.g.. research, write reports, give presentations, collect data, compute conclusions, prepare audio/video communications).

V. Module: Work Place Communications

A. Topic: **Customer Relations**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will demonstrate effective listening and communication skills in dealing with customers.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Demonstrate an understanding of customer attitudes/needs, and strategies to conduct good customer relations. (A)
  b. Demonstrate good listening skills. (S)
  c. Demonstrate effective communication skills. (S) (A)

- Suggested Instructional Strategies:

  1. Have students view the video "Customer Relations: The Winning Formula" from American Honda Corporation.

  2. Have students relay a whispered message to one another. The intent is a distorted end result, thereby demonstrating poor listening skills.

  3. Have students role play a counter situation and record it using a video camera. As a class, critique the performances.

B. Topic: **Parts and Inventory Control**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will demonstrate the effective use of a computer and parts/inventory control system.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Use a computer to manipulate data. (S)
  b. Use parts/inventory programs. (S)

- Suggested Instructional Strategies:

  1. Have students use the computer program "Microbiz" in conjunction with each related activity.

  2. Have students visit an auto dealership to see how it develops service records.

  3. Have students write a warranty claim using service records as evidence.

D. Topic: **Management Skills**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will demonstrate good management skills.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Demonstrate an understanding of worker attitudes/needs. (A)
  b. Describe strategies for being a good manager. (A) (K)
  c. Demonstrate good communication skills. (S)

- Suggested Instructional Strategies:

  1. Have students view the video "Customer Relations: the Winning Formula" from American Honda Corporation.

  2. Have students role play a worker/management situation and record it with a video camera. As a class, critique the performance.

  3. Have students rotate the duty of "Foreman."

E. Topic: **Billing**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will demonstrate the proper use of parts/time references and complete related invoices.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Use parts/time references. (K)
  b. Calculate "Flat Rate" hours, sales tax and total parts costs on an invoice. (S)

- Suggested Instructional Strategies:

  1. Have students use parts/time references to generate invoices for each applicable topic.

  2. Have the students work with the business department students.

  3. Have the students use the computer program "Microbiz."

F. Topic: **Marketing**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will demonstrate effective marketing of automotive parts or service.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify marketing strategies. (K)
  b. Make use of demographic profiles. (K)
  c. Communicate the advantages of an automotive product or service to a consumer. (S)

- Suggested Instructional Strategies:

  1. Have students prepare a bulletin board of local automotive advertisements.

  2. Have students prepare a project in conjunction with the marketing students.

  3. Using a demographic profile of the local area, have students select the most cost-effective method of local advertisement.

VI. Module: Consumer Issues

A. Topic: Purchasing

- Performance Statement:
  Upon satisfactory completion of this topic, the student will demonstrate knowledge relating to the purchase and financing of new and used cars.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Complete a "Buying a Used Car" analysis. (K) (S) (A)
  b. Demonstrate component selection and financing of a new car. (K) (S)

- Suggested Instructional Strategies:

  1. Have students view a film about "Buying a Used Car."

  2. Have students use a "used car checklist" on a vehicle of their choice.

  3. Have students use the computer program "Chevy Tech".

B. Topic: Repair Facilities

- Performance Statement:
  Upon satisfactory completion of this topic, the student will be able to list sources to determine reputable repair facilities.

- Competencies to be Developed:
  After studying this topic the student will be able to:
  a. Identify the characteristics of the following businesses: dealership, independent garage, specialty shop, gas station, home mechanic. (K)
  b. Describe manufacturer's and shop warranties. (K)
  c. Describe the importance of estimates. (K)

- Suggested Instructional Activities:

  1. Have students call auto repair facilities for estimates.

  2. Have students contact the Better Business Bureau for a list of local repair facilities with complaints against their service.

  3. Collect samples of work orders from area businesses and have students complete a specific repair job.

C. Topic: **Maintenance and Prevention Records**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will understand the importance of maintaining accurate maintenance records.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Describe manufacturer's warranties. (K)
  b. Complete a maintenance record similar to the owner's manual. (K) (S)

- Suggested Instructional Strategies:

  1. Have students write a simulated warranty claim letter to a regional zone office of an auto manufacturer, supporting the claim with maintenance records.

  2. Have students listen to a guest speaker on the subject of warranty claims.

D. Topic: **Car Insurance**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will understand the minimum requirements for car insurance in New York State.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Describe the terms liability, collision, and comprehensive insurance. (K)
  b. Describe the minimum coverage required in New York State. (K)

- Suggested Instructional Strategies:

  1. Have students call an insurance company to determine the cost of minimum coverage.

E. Topic: **New York State Inspection**

- Performance Statement:
  Upon satisfactory completion of this topic, the student will understand the requirements for New York State vehicle inspection.

- Competencies to be Developed:
  After studying this topic, the student will be able to:
  a. Identify the components covered under New York State inspection. (K)

- Suggested Instructional Strategies:

  1. Have students perform a New York State inspection on a selected vehicle.

  2. Have students complete an activity sheet listing all the requirements of a New York State inspection.

  3. Have the students visit a licensed New York State inspection station.

SUGGESTED TOOLS AND EQUIPMENT

Student Hand Tools
(Individual or Tool Crib In Sufficient Quantities To Permit Efficient Instruction)

Tools/Equipment	Different Types/Sizes
Allen Wrench	2mm - 7mm.
	.050 thru 3/8
Adjustable Wrench	10 inch
Battery Tools	Battery Nut Pliers
	Battery Terminal Clamp Fuller
	Battery Post Cleaner
Blow Gun	Rubber Tip (OSHA approved)
Brake Spoon	
Chisel	5/8" Cold Chisel
	5/16" Cape Chisel
Combination Wrenches	7/16" - 1", 7mm - 19mm
Files	10" Coarse, 6" Fine
Hack Saw	
Hammers	Medium Ball Peen
	Soft Face
Magnetic Pickup Tool	
Mechanics Steel Ruler	
Pliers	Needle Nose
	All Purpose
	Hose Clamp
	Side Cutters
	Vice Grip
	Slip Joint (water pump)
Punches	1/4" and 1/8" Pin Punch
	3/8" Taper Punch
	3" Center Punch
Safety Glasses	
Scraper	1 1/2" Wide
Screwdrivers (Common)	Stubby 6", 12", 9" Offset
(Phillips)	Stubby #1 and #2
	6", #1 and #2
	12", #3
	Offset #2
(Torx)	T-15, T-20, T-25, T-30
Screw Starter (Standard and Phillips)	

Tools/Equipment	Different Types/Sizes
Socket Set 1/4 Drive	3/8" - 1/2" Standard and Deep 6mm - 12mm Standard and Deep Rachet Long and Short Extension
Socket Set 3/8" Drive	5/16" thru 3/4" Standard (6 pt) 3/8" thru 3/4" Deep (6 pt) 6mm to 19mm 9mm to 19mm Deep Universal Joint Rachet Handle Short, medium and long extension Spark Plug Sockets - 5/8" and 13/16" Speed Handle Breaker Bar
Spark Plug Gap Gauge	
Tape Measure	
Tire Pressure Gauge	
Tool Box	
Wire Brush	

Additional Tools

The tools on this list are used in the specialty areas. Program personnel must determine which tools are needed in each area.

Tools/Equipment	Different Types/Sizes
Adjustable Wrench	6"
Allen Wrench	2mm thru 7mm. .050" thru 3/8"
Box End Wrench Set	3/8" - 1 1/8" 7mm - 18mm 3/8" - 3/4" Offset -- Optional 7mm - 15mm Offset
Belt Tension Gauge	
Brake Tools	Brake Cylinder Hone Brake Cylinder Clamps Brake Spring Installer Brake Plier Brake Rotor Gauge
Creepers	

Tools/Equipment	Different Types/Sizes
Chisels	3/8", 3/4" Cold Chisel
Compression Tester	
Continuity Test Light	
Dial Indicator Set	
Digital Electronic Volt Meter	
Drag Link & Shock Tool	
Drill	3/8" Variable Speed, Reversible
Drill Bits	1/16" - 3/8"
East Outs	1 set
Filter Wrench	Oil and Gas
Engine Tools	Cylinder Hone
	Piston Ring Extender
	Piston Ring Compressor
	Piston Ring Grove Cleaner
	Ridge Remover
	Telescopic Gauge
	Valve Spring Compressor
Feeler Gauges	.002" - .040" Set, .006mm - .070mm set
Files and Handles	4", 10" and 12" fine
	6" and 12" coarse
	6" and 12" half round
Flare Nut Wrench Set	3/8" - 11/16"
	7mm - 17mm
Hammers	Heavy Ball Peen, 25 oz. Brass, Hand Sledge 5 lb.
Ignition Wrench	Metric Set
	Standard Set
Impact Rachet Wrench	3/8" Drive with Socket Set
	Standard and Metric
Impact Wrench	1/2" Drive with Sockets
Micrometers	0-1", 1-2", 2-3", 3-4", and 4-5"
	0-25mm, 25-50mm, 50-75mm, 75-125mm
Oil Can Pump Type	
Open End Wrench Set	5/16" - 7/8", 8mm - 19mm
Pitman Arm Pry Bar	
Pliers	Snap Ring
	Wheel Weight
Punches	5/16", 3/16", Pin, 1/2", 5/8" Tapered
	6" Center Punch
Pry Bar	16"
Puller	Two Way
	Three Way
Roll-Around Tool Cabinet	

Tools/Equipment	Different Types/Sizes
Scraper	Carbon Remover
Screw Pitch Gauge	N.F., N.C., Metric
Screwdriver (Clutch Head)	3/16", 5/16", 1/4", 3/8"
Socket Set 1/2" Drive	10mm - 25mm Standard 10mm - 25mm Deep 7/16" - 1 1/8" Standard 1/2" - 1 1/8" Deep Ratchet Speed Handle Flex Handle (Breaker Bar) Short, Medium and Long Extension
Socket Set 1/4" Drive	3/8" - 1/2" Standard and Deep 6mm - 12mm Standard and Deep Ratchet Short and Long Extension
Soldering Gun	
Spark Plug Wire Remover	
Tach/Dwell Meter	Electronic Capabilities With Digital and Analogue
Tap and Die Set	Standard and Metric
Timing Light With Inductive Pickup	
Magnetic Timer	
Top Tool Chest	6 Drawer Minimum
Torque Wrench	1/2" Drive, 0-150 ft./lbs. -- 0-200 Nm 3/8" Drive, 5-75 ft./lbs. -- 5-100 Nm
Tubing Cutter With Flaring Tool, Double Flare Type	
Vacuum/Pressure Gauge	
Water Manometer	
Battery Post Cleaner, Top/Side Post	
Brake Adjusting Gauge/Universal Brake Spoon	
Combination Wrenches	Start With 9/32 to 7/8, 6mm to 19mm
Feeler Gauge	.002" - .040" + .006mm - 1070mm
Flare Nut Wrench Set	3/8" - 3/4", 10mm - 17mm
Tubing Cutter	
East Out Set	
Hammer	32 oz., S 12 oz. Ball Peen Hammer
Inspection Mirror	
Mallet	Plastic or Wooden
Hammer	Brass
Magnetic Pickup Tool	Three sizes
Fingers	

Tools/Equipment	Different Types/Sizes
Fender and Seat Covers	
Punch	Brass or Aluminum - 6"
Test Light	12 Volt
Pry Bar	16"
Tire Chuck	
Tire Valve Core Remover	
Ignition Wrench Set	Metric and Standard
Special Scraper for Aluminum Parts	
Torx Complete Set	All Sizes
Allen Wrench	2mm - 14mm .50 - 3/8"
Remote Starter Switch	
Box End Wrench Set	1/2" - 1 1/8", 7mm - 19mm 3/8" - 3/4" Offset
Open End Wrench Sets	5/16" - 7/8", 8mm - 19mm
Chisels	3/8" - 3/4"
Drill Bits	1/64" - 1/2"
Torque Wrench Set	3/8" Drive 0-200 in./lbs. 1/2" Drive 5-150 in./lbs.
Flashlight	
Adjustable Wrench	6", 8", 12"
Crows Foot Wrench Set	Metric and Standard
Thread Chaser Set	
Drill	1/2", Variable Speed, Reversible
Files and Handle	Complete Set
Impact Wrench	1/2" Drive With Complete Socket Set/Deep and Standard
Flare Nut Wrench Set	To 3/4", to 19mm
Inside Micrometers	0-6" and 0-150mm
Pliers Snap Ring	Add Complete Set Reversible
Aligning Punch	12"
Flex Socket Set	1/4", 3/8", and 1/2" Drives Metric and Standard
On Board Computer Tester	Hand Held

Shop Tools and Equipment

This section covers the tools and equipment a laboratory should have for training in any given specialty area. Many of the tools and equipment are the same for some or all of the specialty areas, but some equipment is specialized and must be available in the laboratory to provide quality instruction. No specific type or brand names are identified because they will vary in each local situation.

NOTE: It is assumed that all laboratories have an air compressor, adequate electrical capability, fender covers and steel work benches with vises.

Front End

Tools/Equipment	Different Types/Sizes
Axle Stands	
Bearing Packer	Hand Operated
Chassis Lubricator System	
Floor Jack(s)	2 Ton Minimum
Hoist(s)	Swing Arm Frame Contact
Oxy-Acetylene Welder and Cutting Torch	
Parts Cleaning Tank	
Tire Mounting Machine	
Wheel Balancer	On Car Spin Balancer Off Car Electronic Type
Compressor Tool	Spring/Strut
Air Chisel With Adapter	
Tie Rod Puller	
Ball Joint Press and Other Special Tools	
Pressure Gauge	Tire
Dial Indicator Sets	
Impact Wrench	1/2" Drive, and Sockets

Brakes

Tools/Equipment	Different Types/Sizes
Axle Stands	
Bearing Packet	Hand Operated
Bench Grinder	
Brake Bleeder, Pressure	
Floor Jack	2 Ton
Hoist(s)	Swing Arm Frame Contact
Hydraulic Press (with adapters)	25 Ton
Oxy-Acetylene Welder - Cutting Torch	
Parts Cleaning Tank	
Puller(s)	
Torque Wrench	1/2" Drive 0-150 ft./lbs. 3/8" Drive 5-75 ft./lbs.
Brake Drum Micrometers	
Rotor Gauge	
Brake Disk Micrometer	
Method for Removing Asbestos Contamination	

Heating and Air Conditioning

Tools/Equipment	Different Types/Sizes
Air Conditioner Repair Unit	Consisting of pullers, removers, adapters, special feeler gauges, tools, system analyzer, necessary hoses, leak detector, circuit tester, thermometer, ratchet, refrigerant can, dispenser valves, and portable vacuum pump
Axle Stands	
Bench Grinder	
Cooling System Tester	
Dial Indicator	
Floor Jack	2 Ton Minimum
Gear Puller(s)	
Hydraulic Press	25 Ton
Oxy-Acetylene Welder	
Digital Volt, Ohm, Amp Meter With Adapters	
Torque Wrench Set	1/2" Drive 0-150 ft./lbs. 3/8" Drive 0-75 ft./lbs.
Belt Tension Gauge	
Service Port Adapter Set	

Performance

Tools/Equipment	Different Types/Sizes
Arbor Press or Hydraulic Press	25 Ton With Adapters
Axle Stands	
Battery Charger	
Battery/Starter Tester	
Bench Grinder	
Dial Indicator Set	
Engine Analyzer	With or Without Scope
Four Gas Analyzer	
Floor Jack	2 Ton Minimum
Parts Cleaning Tank	
Puller Set	
Spark Plug Cleaner	
Digital Volt Meter - With Adapters	
Cylinder Leakage Tester	
Belt Tension Gauge	
Torque Wrench Set	1/2" Drive 0-150 ft./lbs. 3/8" Drive 0-75 ft./lbs.

Tools/Equipment	Different Types/Sizes
Computer Diagnostic Tester	Hand Held
Fuel Injection Pressure Gauge Sets	
Advanced Timing Light	
Dwell Meters	Hand Held
Computer Carburetor Tools	
Carburetor Plug and Angle Gauge Set	
Fuel Injection Cleaner	
Pyrometer	
Vacuum Gauges and Vacuum Pump	
Manometer	

Automatic Transmission/Transaxle

Tools/Equipment	Different Types/Sizes
Arbor Press	
Axle Stands	
Bench Grinder	
Floor Jack(s)	2 Ton Minimum
Hoist(s)	Swing Arm Contact
Transmission Cleaning System	
Hydraulic Press	25 Ton With Adapters
Parts Cleaning Tank	
Puller Sets	
Transmission Jack(s)	
Transmission Holding Fixtures	
Transmission Special Tool Sets	
Hydraulic Pressure Gauge Set	
Front Wheel Engine Support Fixture	
Dial Indicator Set	
Digital Electronic Volt/Ohm Meter	
Tach Dwell Meter	
Torque Wrench	1/2" Drive 0-150 ft./lbs. 3/8" Drive 0-75 ft./lbs.
Tap and Die Set	Standard and Metric
Waste Oil Receptacle	With Extension Neck and Funnel
Computer Diagnostic Tester	Hand Held

Electrical Systems

Tools/Equipment	Different Types/Sizes
Arbor Press	
Axle Stand(s)	

Tools/Equipment	Different Types/Sizes
Battery Charger	
Battery/Starter Tester	
Floor Jack(s)	2 Ton Minimum
Grinder	
Parts Cleaning Tank	
Puller Set	
Volt-Ampere Tester	
DOVM Digital	
Computer Diagnostic Tester	Hand Held
Engine Analyzer (Scope)	
Analog Volt/Ohmmeter	
Alternator Service Tools	

Manual Drive Train and Axles

Tools/Equipment	Different Types/Sizes
Axle Stand(s)	
Bench Grinder	
Brake Bleeder	
Dial Indicator Set	
Floor Jack(s)	2 Ton Minimum
Hoist(s)	Swing Arm Frame Contact
Holding Fixtures	
Cleaning System	
Hydraulic Press	2 Ton Minimum
Lube Dispenser	
Oxy-Acetylene Welder	
Parts Cleaning Tank	
Portable Crane	2 Ton
Puller Sets	
Transmission Jack(s)	
Drain Pans	
Special Tools for Transaxles	
Front Wheel Drive Engine Support Fixture	
Torque Wrench	1/2" Drive 0-150 ft./lbs. 3/8" Drive 0-75 ft./lbs. 1/4" Drive 0-75 in./lbs.
C V Joint Tools	
Universal Joint Tools	

Engine

Tools/Equipment	Different Types/Sizes
Axle Stand	
Bench Grinder(s)	
Engine Analyzer	
Floor Jack(s)	2 Ton Minimum
Gear Puller Set	
Hydraulic Press	25 Ton With Adapters
Parts Cleaner	
Portable Crane	2 Ton
"Valve Shop"	Including Refacer and Seat Grinder, and Valve Guide Repair Unit
Drill Motor	1/2"
Drive Impact Wrench	1/2"
Impact Socket Sets	1/2" Drive, Standard and Deep
Cam Bearing Driver Set	
Valve Spring Tester	
Engine Stands	
Piston Pin Press and Adaptors	
Compression Gauge	
Cylinder Leakage Tester	
Cylinder Hone	
Dial Indicator Sets	
Electronic Digital Volt/Ohm/Amp Meter	
Tap and Die Set	
Torque Wrench	1/2" Drive 0-200 ft./lbs. 3/8" Drive 0-75 ft./lbs.
Telescopic Gauges	
Ball Gauges	

Business Operations

- One computer station with appropriate software to prepare work orders, customer receipts and maintain inventory and related service records.

- Computer station with CD Rom player and appropriate reference software to provide information needed for diagnosis and repair of automobiles and light trucks.