PHILOSOPHY

Business and Technology Education

The philosophy of business and technology education is to assist students in becoming productive and contributing members of society capable of self-sufficiency, lifelong learning and adapting to change.

Business and technology programs are competency-based, providing experiential learning that uses employment-related content to contribute to the development of a student's basic, academic and problem-solving skills, general employability attributes, and specific occupational knowledge. The acquisition of these skills, knowledge and attributes prepares students for success in employment, further education and their personal lives.

Business and technology education serve diverse individual interests, accommodate different learning styles, and provide students with opportunities to master essential skills through practical application. Courses within our departments require students to demonstrate their knowledge, skills, and attitudes through hands-on experiences.
STATEMENT OF PURPOSE

Business and Technology Education

This curriculum has been organized to align the Newtown High School business and technology education programs with the State of Connecticut Vocational-Technical Education Policy Statement, the National Standards for Business Education, the Newtown School District Quality Model and the High School Common Denominator.

As stated in our philosophy, our business and technology programs are competency-based, providing experiential learning for our students to become contributing citizens of our society. Further, the acquisition and melding of skills, knowledge and attributes prepare students for success in employment, additional education, and their personal lives. Analogous to this philosophy is the vision statement of the Common Denominator document, "The purpose of our school is to prepare all students to be productive workers, lifelong learners, and responsible citizens."

To this end, our curricula is designed with heavy emphasis on the Common Denominator's productive worker. In addressing the productive worker essential question, "How do I know that I have created and produced significant work?", we endorse and adhere to the follow content standards:

- The student accesses, organizes, analyzes, interprets, and uses information to create an accurate and sound project.
- The student communicates effectively with others in completing a project.
- The student evaluates both process and product to improve the project.
- The student sets goals, develops a plan to meet the goals, monitors and readjusts when necessary for goal attainment.
- The student demonstrates pride in workmanship.

We believe that these standards are the essential operating elements within all the courses taught in our programs.
Technology Education - Grades 6 -12
Scope and Sequence

Self-Awareness/Technology Exploration - Grades 6-8

Programs at this level are designed to develop self-awareness by exposure to fundamental concepts. The incorporation of tools, materials and processes reinforces basic science/ math and language arts principles.

<table>
<thead>
<tr>
<th>Grades</th>
<th>Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>6, 7, 8</td>
<td>Planning and Design</td>
</tr>
<tr>
<td>6, 7, 8</td>
<td>Woods</td>
</tr>
<tr>
<td>7, 8</td>
<td>Plastics</td>
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</tbody>
</table>

Technology Enrichment/Occupational Orientation - Grades 9-12

Students will gain an understanding of consumer awareness and personal enrichment as well as an approach to occupational readiness through an expanded variety of offerings.

<table>
<thead>
<tr>
<th>Course</th>
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<tbody>
<tr>
<td>Wood Technology 1, 2</td>
</tr>
<tr>
<td>The student will develop skills and learn techniques in the use of numerous hand tools and power equipment used to construct wood products.</td>
</tr>
<tr>
<td>Introduction to Drafting 1, 2</td>
</tr>
<tr>
<td>The student will be exposed to all of the basic equipment, drawing and dimension techniques used in the field of drafting today. Emphasis will be on the development of the ability to visualize various views of an object.</td>
</tr>
<tr>
<td>Graphic Arts Industries 1, 2</td>
</tr>
<tr>
<td>The student will study the basic graphics of communication including design, layout, typography as well as numerous types of printing and printing media.</td>
</tr>
<tr>
<td>Graphic Design and Illustration</td>
</tr>
<tr>
<td>The student will survey a wide variety of mechanical drafting techniques. This course is for the student with no previous drafting experience.</td>
</tr>
<tr>
<td>Home Mechanics</td>
</tr>
<tr>
<td>The student who has no knowledge or experience in mechanical areas will learn basic maintenance of the automobile and home.</td>
</tr>
<tr>
<td>Power Technology 1, 2</td>
</tr>
<tr>
<td>The student will be introduced to energy and power systems, including numerous internal combustion engines and repair processes.</td>
</tr>
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</table>

Technology Specialization - Grades 10-12

At this level students are provided the opportunity to specialize in one or more technical areas and/or to develop some pre-vocational skills for post secondary educational purposes.

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Wood Technology 3, 4</td>
</tr>
<tr>
<td>The student will study the techniques and joinery used to design and construct basic case work.</td>
</tr>
</tbody>
</table>
Engineering Drawing 1, 2
The student will do orthographic projections, sections, auxiliaries and isometric drawings as they relate to machine products. This will include geometric tolerance and work with precision measuring instruments.

Cabinet Making
The student will study techniques and materials used to construct fine period furniture and contemporary casework.

Auto Mechanics 1, 2
The student will be exposed to a 50/50 lecture/lab course which covers most automotive systems except automatic transmissions and dashboards. Included will be: electrical, fuel, engines, brakes, emissions, tires and suspensions. Some auto body techniques will be included.

Introduction to House Construction
The student will be introduced to the complete process of constructing a house.

Architectural Drawing 1, 2
The student will be exposed to the many facets of architectural design and building. A complete set of plans will be developed by each student.

Basic Photography
The student will be introduced to the camera, its operation and systems. Also covered is complete darkroom theory and the development of both black and white negatives and prints.

High Tech Auto Mechanics
The student will be exposed to a lecture/lab course with more emphasis on lab work for the development of skills in this area. New information will include: electronic fuel management, oxyacetylene torch operation, and complete automotive computer systems and diagnosis.

Photographic Exploration
The student will be working in both black and white, and color photography. emphasis will be on individual composition, and advanced photo techniques.

Survey of Woods
The student who has had no previous woodworking experience will have an opportunity to experience a variety of woodworking processes.

Research and Skill Development 1, 2
The student wishing to gain in-depth study in a particular technology has the option to do individual research and develop skills in a particular area.

Newtown Graphics - The Company 1,2
The student will expand his/her knowledge in the graphics and business fields. This course is designed for the advanced graphic arts student.
Introduction

Auto Mechanics I and II are courses offered at Newtown High School during the fall and spring semesters respectively. These courses are sequential and both consist of approximately 50 (but not more than) lab work, with the remainder devoted to lectures and demonstrations. Labs will primarily give the students an exposure to real world service, maintenance and overhaul of many automotive systems used today. Classroom time is essentially instructor lectures and demonstrations. Students are required to take comprehensive notes, therefore instruction is specifically designed and presented to help facilitate this.

Auto Mechanics I and II is not intended to prepare anyone for a career as an automotive technician/mechanic. It is, however, a good general introduction and will expose students to proper maintenance and repairs they are capable of doing themselves. Thus they will be better consumers of an item nearly everyone will own and have to deal with.

The Town of Newtown has always advocated an educational philosophy of continuous improvement, thus it should be understood that some of the material presented in this guide may be changed or modified at the discretion of the instructor.
Course Objectives

1. The student will recognize the need for various tools and equipment related to this area.
2. The student will be able to safely and properly use many common automotive tools and equipment.
3. The student will recognize the need for and value of good automotive maintenance.
4. The student will understand what is and/or should be involved in many automotive repairs, thus making him/her a more knowledgeable consumer.
5. The student will realize the expenses typically incurred with the ownership of an automobile.
6. The student will be able to recognize good and bad features in automotive design.
7. The student will be confronted with the true meaning of responsibility.
8. The student will work cooperatively in groups.
9. The student will be confronted with the need for good diagnosis and problem-solving.
10. The student will understand the nature of information as given in service manuals.
11. The student will realize the importance and need for technical service manuals.
12. The student will understand what is involved in various careers that relate to the automotive field.
13. The student will recognize the need for neat and orderly work habits.
14. The student will gain an appreciation for the value of tools, equipment and the property of others.
Course Outline

Auto Mechanics I

I. Safety (reviewed with any unit when necessary)
   A. Personal
   B. Use of tools and equipment
   C. Working with a car

II. Automotive Special Tools and Supplies
   A. Location
   B. Use
   C. Specifications
   D. Precautions

III. Raising and Moving a Car in the Shop
   A. Outdoor Rotary lift
   B. Indoor Walker lift
   C. Floor jacks
   D. Jack stands
   E. Wheel dollies

IV. Servicing the Automobile
   A. Things to replace
   B. Things to check/adjust
   C. Things to inspect
   D. Various lubricants to use
   E. Location of components

V. Automobile Tires
   A. Sizing
      1. U.S.
      2. Metric
   B. Construction
   C. Design advantages and disadvantages
   D. Repair
   E. Replacement
      1. Tire machine operation
      2. Tire pressures
   F. Balancing
      1. Static
      2. Dynamic (computer)
VI. Basic Auto body Repair

A. Supplies
   1. Sandpaper grits
   2. Cleaning chemicals
   3. Body filler

B. Tools
   1. Air sanders
   2. Grinders
   3. Dent pullers
   4. Dollies
   5. Hammers

C. Panel/Fender Repair
   1. Rust removal
   2. Hammering
   3. Pulling
   4. Body fillers
   5. Body putties
   6. Sanding

D. Surface Refinishing/Paint
   1. Types of paint
   2. Types of thinners
   3. Spray guns
   4. Spraying techniques

VII. Engine Emissions and Tune-Up

A. Air pollutants
   1. HC
   2. CO
   3. NOX

B. Emissions Analyzer
   1. Calibration
   2. Adjustment
   3. Four gas analyzing

C. Basic Engine Tune-Up
   1. Ignition system and timing
   2. Replacement items
   3. Carburetor adjustment

D. Emission Failure Corrective Procedures
   1. Timing
   2. Fuel mixture
VIII. The Oxygen-Acetylene Torch

A. Uses
   1. Welding
   2. Brazing
   3. Cutting

B. Equipment Used

C. Adjustments

D. Operational procedures

E. Safety

IX. Brake Systems

A. General Components
   1. Linings
   2. Hydraulics
   3. Valves
   4. Lines and hoses

B. Problems, Causes and Corrections

C. Shoe Type
   1. Springs
   2. Wheel cylinders
   3. Installation and adjustments

D. Disc Type
   1. Rotors
   2. Calipers
   3. Installation

E. Anti-lock Brakes
   1. Operation
   2. Components

Auto Mechanics II

X. Engine Systems

A. Basic Engine Operation

B. Turbo and Super-Chargers

C. Engine Support Systems
   1. Lubrication
   2. Crankcase ventilation
   3. Cooling
   4. Cam driving mechanisms

D. Periodic Maintenance

E. Diagnosis and Repair
XI. Engine Breathing and Overhaul
   A. Camshaft Design
   B. Performing a Valve Job
      1. Disassembly
      2. Cleaning and grinding
      3. Valve train components
      4. Valve seals
      5. Valve train adjustment
   C. Heat Riser System
      1. Operation
      2. Components
      3. Problems
   D. Major Overhaul
      1. Components to replace
      2. Components to repair
      3. Components to measure
      4. Overhaul operations
      5. Assembly
      6. Adjustments
      7. Special tools

XII. Electricity and Ignition Systems
    A. Electricity Explained
    B. Electrical Measurements
       1. Volts
       2. Ohms
       3. Amps
    C. Electrical Circuits
       1. Wiring
       2. Problems
       3. Testing
    D. Electrocution
    E. Ignition Systems
       1. Operation
       2. Standard
       3. Electronic
       4. Components
       5. Adjustments
       6. Diagnosis
    F. Related Problems
XIII. Introduction to Automobile Computers
   A. Origin and Development
   B. System Components
      1. Computer
      2. Sensors
      3. Controls
   C. Basic Electronics
      1. Circuits
      2. Components
   D. Sensors Defined
   E. Controls Defined
   F. Introduction to System Operation
      1. Interaction
      2. Purpose
      3. Problems
      4. Methods

XIV. Auto Computer Operation and Diagnosis
   A. Component Methods of Interaction
   B. Component Operation Explained
      1. Computer
      2. Controls
      3. Sensors
      4. Relationship
   C. Computer Modes
   D. Diagnosis and Repair
      1. Equipment
      2. Manuals
         a. Trouble codes
         b. Flow charts
         c. Use of
         d. Location of information
      3. Check engine
      4. Causes
      5. Corrections
XV. Fuel Systems
   A. Methods of delivery
   B. The Carburetor
      1. Theory of operation
      2. Components
      3. Overhaul
   C. Fuel Injection
      1. Theory of operation
      2. Components
      3. T.B.I.
      4. Advantages
      5. Electronic control
      6. P.F.I.
   D. Tuned Systems

XVI. Emission Control Devices
   A. Evolution
   B. Purpose and Effects
      1. For the ecology
      2. For the engine performance
      3. For driveability
   C. Major Engine Modifications in Design
   D. Basic Controls
      1. Description
      2. Maintenance
      3. Problems

XVII. Drive Lines and Suspension Systems
   A. The Front End
      1. Suspension components
      2. Steering components
      3. Alignment
      4. Special tools
   B. Rear Suspension
      1. Methods of support
         a. characteristics
         b. replacement
   C. Drive Shafts
      1. Front wheel drive
      2. Rear wheel drive
      3. Joints
      4. Problems and symptoms
Unit 1: Safety

Objectives:

The student will:

− Identify all potentially dangerous areas when working on a automobile.
− Be knowledgeable of the safe and proper use of all auto mechanic tools and equipment.
− Pass the Lab Safety Exam with a minimum grade of 70.

Content:

A. Awareness of Safety

B. Accident Prevention

C. General Safety Rules
   1. Safety glasses
   2. Gloves and proper clothing
   3. Cleaning materials - M.S.D.S.
   4. Use of hand tools
   5. Starting of engines in the shop
   6. Moving or jacking up cars in the shop
   7. Fire extinguishers
   8. Reporting injuries
   9. Shop power buttons
   10. Cleaning the shop
   11. Proper personal conduct

D. Equipment Safety (will be reviewed when each are specifically demonstrated)
   1. Grinding machine
   2. Torches
   3. Tire machine
   4. Steam cleaner
   5. Hydraulic press
   6. Emissions analyzer
   7. Engine hoist
   8. Brake lathes
   9. Auto lifts
   10. Compressed air
   11. Jacks and horses
   12. Drill press
   13. Sandblaster
Reference Material:

Auto Mechanics Fundamentals Stockel, Chapter 21

Relating Activities:

1. Students will take comprehensive notes covering the complete safety lecture.
2. Fire drills
3. Students will practice all safety procedures when working in the lab.
4. Students will take the Lab Safety Exam.
Unit 2: Automotive Tools And Supplies

Objectives:

The student will:

− Know the proper use and operation of all auto shop hand tools.
− Be able to select the best tool for the job.
− Be able to select the best supply item when suitable for a job.
− Recognize the importance of good tool organization.

Content:

A. Review Basic Tool Crib

B. Define and Demonstrate Auto Special Tools
   1. Pullers
   2. Electronic meters
   3. Compression tester
   4. Radiator pressure tester
   5. Vacuum gauge
   6. Pickel forks
   7. Air wrench
   8. Clutch tools
   9. Flaring tools
  10. Brake tools
  11. Battery tester
  12. Special wrenches
  13. Engine overhaul tools
  14. Rivet gun
  15. Auto service tools

C. Review the Use of all Shop Supplies
   1. Cleaners
   2. Lubricants
   3. Glues
   4. Form-a-gasket
Reference Material:

Auto Mechanics Fundamentals Stockel, Chapter 9

A.V. Material:

'Specialty Auto Mechanics Tools in Action' - slides - O'Loskey

Related Activities:

1. Students will take comprehensive notes.
2. Students will use tools during labs.
3. Students will use tools at home.
4. Students will take Automotive Tool Exam.
Unit 3: Lifting and Moving Automobiles

Objectives:

The student will:

- Be able to operate the two different types of auto lifts.
- Describe the construction characteristics of unibody and full-frame automobiles.
- Know the proper location for jacks and horses.

Content:

A. Outdoor Rotary Lift
   1. Location of car
   2. Adjustment of arms
   3. Controls
   4. Safety locks

B. Indoor Twin Post Lift
   1. Location of car
   2. Rear V-plate adjustment
   3. Controls

C. Floor Jacks and Horses
   1. Location on unibody vehicles
   2. Location on full-frame vehicles

D. Wheel Dollies
   1. Placement and movement in the shop

Reference Material:

   Autobody Repairing and Repainting Toboldt, Chapter 8

Related Activities:

1. Students will take comprehensive notes on use of equipment.
2. Students will operate lifts during labs.
3. Students will jack, move, and secure cars during labs.
Unit 4: Routine Automobile Service

Objectives:

The student will:

- Understand the need and intervals for servicing a car.
- Know the complete procedure for servicing an automobile.
- Understand the difference between various motor oils and lubricants.

Content:

A. Need for
   1. Longevity of vehicle
   2. Type of driving
   3. Average miles driven annually

B. Operations and Procedures
   1. Chassis lubrication
   2. Change oil
   3. Replace filter
   4. Check suspension
   5. Check tires
   6. Check belts and hoses
   7. Check exhaust system
   8. Check gear lube
   9. Check accessory fluids
  10. Check for leaks
  11. Check for damage
  12. Replace door sticker

C. Lubrication
   1. Ball joint variations and locations
   2. Gear lube
   3. Understand fluids
   4. Motor oils
      a. viscosity vs. climate
      b. API service rating
      c. synthetic vs. standard

Reference Material:

Auto Mechanics Fundamentals Stockel, Chapter 5

Related Activities:

1. Students will take comprehensive notes.
2. Students will bring in cars to be serviced during labs.
3. Students will take Auto Exam on Lifts and Basic Servicing.
Unit 5: Tires

Objectives:
The student will:

− Understand the different tire sizing systems used.
− Realize the advantages/disadvantages of different types of tire construction.
− Be capable of mounting, balancing or changing a tire.

Content:

A. Tire Sizing
   1. Past U.S. systems
   2. Present metric system

B. Tire Construction
   1. Bias
   2. Belted
   3. Radial
   4. Materials
   5. Tread design
   6. Characteristics

C. Wear Patterns
   1. Tire pressure
   2. Front/rear alignment
   3. Rotation

D. Tire Replacement
   1. Dismounting
   2. Mounting
   3. Rubber lube
   4. Valve
   5. Inflation
      a. Girdle
      b. Doughnut ring
      c. Inflation station

E. Tire Balancing
   1. Objective
   2. Install/remove weights
   3. Dynamic computer balancer
      a. Adjusting machine
      b. Mounting on machine
      c. Controls and operation
      d. Adapters
4. Static bubble balancer
   a. Position of tire
   b. Location of weights

F. Tire Repair
   1. Outside plugs
   2. Inside patch

AV Materials:
Cutaway radial, belted and bias models - Uniroyal Tire Co.
Video - The Building of a Tire' - Firestone

Related Activities:
1. Students will take comprehensive notes.
2. Students will bring in cars/tires to mount, balance, repair and/or install.
3. Students will take the Auto Tire Exam.
Unit 6: Basic Auto Body Repair

Objectives:
The student will:

- Have an understanding of what is involved in the auto body trade.
- Know the procedure for removing a dent.
- Know the procedure for refinishing a panel or car.
- Comprehend the cost for having repair work done.

Content:

A. Auto Body Supplies
   1. Degreasers
   2. Sand paper grits
   3. Body fillers
      a. Mixing
      b. Spreading
      c. Putty
   4. Paper and tape

B. Tools and Equipment
   a. Air sanders
      a. D.A. sander
      b. Air board
      c. Jitterbug
      d. Grinder
   b. Rasps and files
   c. Dent pullers
      a. Screw type
      b. Spot weld type
   d. Hammers and dollies
   e. Use and applications

C. Panel Repair and Straightening
   1. Dent removal techniques
      a. Pullers
      b. Hammers with dolly
      c. Areas to hit
   2. Rust removal
      a. Use of rust transformers
      b. Grinding and blasting
      c. Cutting
3. Body fillers
   a. Mixing
   b. Spreading
   c. Putty
4. Final sanding techniques
   a. By hand
   b. With block
   c. With air sanders

D. Painting
   1. Types of paint and characteristics
      a. Lacquer
      b. Enamel
      c. Urethane
      d. Epoxy
   2. Paint thinners and reducers
      a. Ambient temperature
      b. Mixing ratio
      c. Hardiness

E. The Spray Gun
   1. Types of guns
      a. Full body
      b. Panel-touch up
      c. Air brush
   2. Adjustments to gun
   3. Spraying techniques

Reference Material:
   Auto Repairing and Repainting Toboldt
   Automotive Refinishing Hobson
   Basic Bodywork and Painting Peterson

Related Activities:
   1. Students will take comprehensive notes.
   2. Students may bring in cars to work on basic body damage, during labs.
   3. Students will take Auto Body Exam.
   4. Students may bring in small miscellaneous items to repair and refinish.
Unit 7: Engine Emission and Tune Up

Objectives:
The student will:

- Be familiar with the pollutants emitted by automobile engines.
- Realize the value of mandatory emissions testing.
- Understand the need for periodic engine tune up, and what is involved.
- Recognize what engine failures and/or adjustments will affect emission output.

Content:

A. Engine Exhaust Emissions
   1. Water
   2. Carbon dioxide
   3. Carbon monoxide
   4. Hydrocarbons
   5. Oxygen
   6. Oxides of nitrogen

B. Exhaust Emissions Analyzer
   1. Four gas analyzer
      a. Purpose
      b. Calibration
      c. Operation
      d. Specifications

C. Engine Tune Up
   1. Review of 4 stroke cycle engine operation
      a. Spark plugs
      b. Spark timing
      c. Distributor
      d. Ignition system
   2. Introduction to carburetors
      a. Idle speed adjustment
      b. Choke adjustment
      c. Fuel mixture adjustment
   3. Filters
      a. PCV
      b. Gas
      c. Air
   4. Equipment
      a. Timing light
      b. Tachometer
D. Emission Related Adjustments
   1. Timing too advanced - high HC
   2. Mixture too rich - high CO
   3. Mixture too lean - high HC
   4. Idle speed too low - high HC and CO
   5. Clogged filters - high HC and CO
   6. Alcohol in fuel

Reference Materials:
   Pamphlet - Helping You Pass Emissions - State of CT.
   Adjustable Cardboard Engine Model - O'Loskey

Reference Books:
   Automotive Emission Control and Tune up Procedures Ignition Manufactures Institute

Related Activities:
   1. Students will take comprehensive notes.
   2. Students will bring in automobiles for tune-up.
   3. Students will bring in automobiles to test for quality of exhaust emissions.
   4. Students will take Auto Emissions and Tune Up Exam.
   5. Students will consult service manuals for related information/specifications.
Unit 8: The Oxygen – Acetylene Torch

Objectives:

The student will:

– Assemble, light and adjust the torch.
– Cut steel with the torch.
– Heat metal with the torch.
– Weld steel with the torch.
– Braze metal with the torch.

Content:

A. Uses
   1. Cut
   2. Weld
   3. Braze
   4. Heat
   5. Solder

B. Welding and Brazing
   1. Tip sizes
   2. Metal thickness
   3. Pressure regulator adjustment
   4. Flame adjustment
   5. Welding and brazing techniques
      a. Steel filler rod
      b. Bronze filler rod with flux

C. Cutting Torch
   1. Tip sizes
   2. Metal thickness, steel only.
   3. Pressure regulator adjustment
   4. Cutting process

D. Soldering
   1. Sheet metal
   2. Copper tubing
E. Safety
   1. Clothing
   2. Eye protection
   3. No oil
   4. Flammable
   5. Fire extinguisher
   6. Surface to work on

Reference Books:
   Welding Processes Griffin

A.V. Materials:
   Filmstrips (3) – ‘The Welding, Brazing and Cutting Process’ - Prentice Hall Media

Related Activities:
   1. Students will take comprehensive notes.
   2. Using scrap metal, students will practice welding, brazing and cutting.
   3. Students will take the Oxygen Acetylene Torch Exam.
Unit 9: Brake Systems

Objectives:

The student will:

− Identify the major brake system components.
− Understand the operation and repair procedures for standard brake systems.
− Understand the operation and purpose for anti-lock brake systems.
− Be capable of diagnosing brake system problems.

Content:

A. Operational Theory for Shoe Type
B. Operational Theory for Disc Type
C. Main Components
   1. Shoes and pads
      a. Organic
      b. Metallic
   2. Master cylinder
   3. Wheel cylinder
   4. Proportioning valve
   5. Caliper
   6. Rotor
   7. Drum
   8. Hoses and lines
   9. Brake fluid
D. Overhaul Shoe Type
   1. Longevity
   2. Shoe location
   3. Spring location
   4. Resurface drums
   5. Adjustment
   6. Spring tools
E. Overhaul Disc Type
   1. Longevity
   2. Pad location
   3. Resurface rotor
   4. Pad expander
F. Hydraulics Overhaul
   1. Master cylinder
   2. Wheel cylinder
   3. Caliper
   4. Bleeding system

G. Anti-lock Brakes
   1. Theory of operations
   2. Special components
      a. electric valve master cylinder
      b. wheel speed sensors
      c. computer

H. Problems and Causes

Reference Books:
   Auto Mechanics Fundamentals Stockel, Chapter 18

A.V. Materials:
   Video 'Anti-lock Brake Systems' Bergwall Productions, Inc.
   Cut-a-way model shoe type system - O'Loskey

Related Activities:
   1. Students will take comprehensive notes.
   2. Students may bring in cars to perform complete brake service.
   3. Students will take the Brake Systems Exam.
Unit 10: Automobile Engine Systems

Objectives:

The student will:

− Identify and explain the theory of operation of the four major internal engine support systems.
− Understand the need for periodic maintenance of related engine component systems, and what is to be performed.
− Identify and explain the operation of the two most common external engine systems used today to increase engine performance.

Contents:

A. Review Basic Engine Operation

B. Turbo Charger Theory of Operation
   1. Impeller
   2. Compressors
   3. Ducts
   4. Bearings
   5. Intercooler
   6. Waste gate

C. Super Charger Theory of Operation
   1. Compressor
   2. Belt
   3. Boost
   4. Nitrous Oxide

D. Lubrication
   1. Splash, pump and mixture
   2. Oil pumps
      a. Gear
      b. Rotor
      c. Location
      d. relief system
   3. Filters
   4. Effective pressure
   5. Bearings
E. Crankcase Ventilation
   1. Purpose
   2. Old road draft system
   3. Positive crankcase ventilation
      a. Location
      b. Valve
      c. Hoses
      d. Filters
   4. Maintenance

F. Cooling System
   1. Theory of operation
   2. Components
      a. Thermostat
      b. Pump
      c. Water jacket
      d. Radiator
      e. Antifreeze
      f. Hoses
      g. Heater core
      h. Pressure cap
   3. Periodic Maintenance
   4. Problems, Causes and Corrections
      a. Acidic antifreeze
      b. Frozen thermostat
      c. Leaks
      d. Bad pump

G. Cam Driving Mechanisms
   1. Location
      a. Internal
      b. External
   2. Material
      c. Chain
      d. Belt
      e. Gears
      f. Nylon coatings
   3. Failure Symptoms
      a. Air blows out of intake
      b. Engine cranks freely
      c. No valve movement
      d. Valves hit piston
4. Replacement
   a. Timing marks
   b. Preventative maintenance

Reference Books:

- Auto Mechanics Fundamentals Stockel, Chapters 2, 4, 5
- Engine Repair Barkhouse, Chapters 7 & 16
- Automotive Encyclopedia Toboldt and Johnson

A.V. Material:

- Overhead transparencies (5) - DCA Products Inc.
- Cut-a-Way Chrysler oil pump system - O'Loskey

Related Activities:

1. Students will take comprehensive notes.
2. Students may bring in a car or engine, to service any of the systems above.
3. Students will take the Auto Engines I Exam.
Unit 11: Engine Breathing and Overhaul

Objectives:

The student will:

1. Understand engine design that will affect its breathing characteristics.
2. Identify all components that should be replaced or reconditioned during an overhaul.
3. Describe all mechanical procedures performed during an overhaul.
4. Be capable of diagnosing major engine problems.

Content:

A. Camshafts
   1. Profile
      a. Lift
      b. Duration
      c. Overlap
   2. Style
      a. Hydraulic
      b. Flat tappet
      c. Roller
   3. Timing location

B. Valve Train
   1. Cam
   2. Lifters
   3. Valve spring
   4. Push rod
   5. Rocker arm
   6. Adjusting

C. Valve Job
   1. Guides
   2. Seats
   3. Seals
   4. Disassembly
   5. Cleaning
   6. Face
   7. Ports
   8. Grinding
   9. Assembly
D. Heat Riser Systems
   1. Theory of Operation
   2. Valves
      a. Mechanical
      b. Electric
      c. Vacuum operated
   3. Intake manifold
   4. Exhaust manifold
   5. Problems and Affects
      a. Sticking
      b. Rattling
      c. Leaking
      d. Carb. Icing
      e. Overheating
      f. Lower performance

E. Major Engine Overhaul
   1. Measurements, clearances
      a. Bearings
      b. Con rods
      c. Crankshaft
      d. Cylinder
      e. Pistons
      f. Rings
      g. Valves
   2. Procedures
      a. Mark for component position
      b. Honing
      c. Grinding
      d. Cleaning
      e. Pre-lube
      f. Torquing
   3. Special Tools
      a. Ridge reamer
      b. Honer
      c. Plastic gage
      d. Micrometer
      e. Grinder
      f. Ring expander
      g. Ring compressor
      h. Torque wrench
4. Replacement parts
   a. Bearings
   b. Pumps
   c. Rings
   d. Timing chain/belt
   e. Cam
   f. Lifters
   g. Rocker arms
   h. Gaskets

Reference Books:

   Automotive Encyclopedia Toboldt and Johnson
   Engine Repair Barkhouse
   Auto Mechanics Fundamentals Stockel
   Mitchell's Professional Service Manuals

A.V. Materials:

   Overhead Transparencies (2) - DCA Products, Inc.
   Cut-a-Way Chevrolet heat riser system - O'Loskey
   A disassembled Ford engine

Related Activities:

1. Students will take comprehensive notes.
2. Students may bring in any engine for a complete overhaul.
3. Students will take the Auto Engines II Exam.
4. Students will consult service manuals for operational procedures and specifications.
Unit 12: Electricity and Ignition Systems

Objectives:

The student will:

- Be capable of reading and understanding basic electrical measurements with a multimeter.
- Identify and explain all components in an ignition system.
- Be capable of diagnosing ignition system failures.
- Compare and contrast the standard ignition system with the electronic system.

Content:

A. Review of Electricity
   1. Origin
   2. Methods of production
      a. Chemical
      b. Magnetism
      c. Friction
   3. Define volts, ohms and amperage.

B. Definition of Electrical Circuits
   2. Complete
   3. Open
   4. Short
   5. Ground
   6. Load
   7. Fuse
   8. Draw
   9. Breaker

C. Discuss of Electrocution

D. The Standard Ignition System
   1. Theory of operation
   2. Transformer principle
   3. Parts
      a. Points
      b. Condenser
      c. Coil
      d. Wires
      e. Battery
      f. Distributor
      g. Rotor
4. Diagnosis Procedures

E. The Electronic Ignition System
   2. Theory of Operation
   3. Characteristics and advantages
   4. Parts
      a. reluctor
      b. Armature
      c. Pick-up coil
      d. Spark coil
      e. Module
   4. Diagnosis Procedures

F. The Distributor
   1. Purpose
   2. Wiring
   3. Adjusting
   4. Replacing

G. Ignition Ping or Knock
   1. Definition and description
   2. Causes
      a. Gasoline
      b. Timing
      c. Compression
      d. Carbon
      e. Mixture

Reference Books:

- Auto Mechanics Fundamentals Stockel, Chapter 3
- Electronic Ignition Service Manual Echlin Corp.

A.V. Materials:

- Video – ‘The Electronic Ignition System’ - Prentice Hall Media
- Complete operating ignition system simulator - Snap on Tool Corp.
- Distributor and ignition parts from Ford, Chrysler & GM

Related Activities:

1. Students will take comprehensive notes.
2. Students will consult service manuals for tune-up specifications.
3. Students may bring in an engine or car for ignition system service.
4. Students will take the Ignition and Electricity Exam.
Unit 13: Introduction to Auto Computers

Objectives:
The student will:
- Define and describe the basic electronic components in an automobile computer.
- Know the objectives of an onboard engine computer.
- Know the objectives of an onboard body computer.
- Be familiar with the size and location of onboard computers.

Content:
A. Evolution
   1. Started in mid 1970's
   2. Need for more precise control
      a. Ignition
      b. Fuel delivery
      c. Emission controls
      d. Performance
   3. Increasing C.A.F.E. standards in the U.S.
   4. Increasing emissions standards in the U.S.

B. Applications
   2. Engine controls (engine computer)
      a. Carburetor
      b. Fuel injection
      c. Air management
      d. Heat risers
      e. E.G.R.
      f. Spark timing
      g. Transmission shifting
   3. Body Controls (body computer)
      a. Heat and air conditioning
      b. Dashboard gauges
      c. Anti-lock brakes
      d. Anti-theft systems
      e. Memory (seat) functions
      f. Stereo systems
      g. Instrument panel
      h. Power operated options
C. Electronic Circuits and Components
   1. Integrated circuits
   2. Printed circuits
   3. Transistor
   4. Resistor
   5. PROM chip
   6. Capacitor
   7. Diode
   8. Resistor
   9. Relay

D. Method of Operation
   1. Senses (sensors)
   2. Decides (computes)
   3. Acts (control components)

E. System Related Components
   1. Sensors
      c. oxygen
d. baro
e. map
f. air flow
g. coolant
h. engine knock
i. throttle position
j. speed
   2. Engine Controls
      a. spark timing
b. fuel injector
c. fuel solenoid
d. EGR valve
e. canister purge
f. transmission servo
g. coolant fan
h. air pump valve

Reference Books:

Computerized Engine Controls, Volumes 1-4 Mitchell Manuals Inc.

A.V. Materials:

Film strips (3) ‘The Automobile On-board Computer System’ - Prentice Hall Media

Complete computer system - computer, controls and sensors from General Motors Corp.
Related Activities:

1. Students will take comprehensive notes.
2. Students will take Intro to Auto Computers Exam.
Unit 14: Auto Computer Operation And Diagnosis

Objectives:

The student will

− Know what information is needed to diagnosis computer system problems, and where to get it.
− Be familiar with a computer diagnostic scanner.
− Understand the complexity and cost involved with automobile computer systems.
− Realize the need for in-depth specialized training required of an automotive technician today.

Content:

A. System Interaction and Operation
   1. Varying voltages
   2. Varying time periods
   3. Varying pressures
   4. Varying resistances

B. Spark Timing Control
   1. Start-up
   2. By-pass
   3. Initial adjusting

C. Fuel Delivery Control
   1. Carburetor
      a. Throttle position
      b. Mixture control solenoid
      c. Mixture control dwell period
   2. Fuel Injection
      a. Injector pulse
      b. Computer integrator

D. Modes of Operation
   1. Open loop defined
   2. Closed loop defined

E. Test Equipment
   1. Multimeter
   2. Computer scanner
      a. Connections
      b. Set-up
      c. Capabilities
   3. Manuals
F. Diagnosing System Problems
   1. Circuit harness connections
      a. Low voltage
      b. Corrosion
      c. Shorts and breaks
   2. Trouble codes
      a. Self diagnostics
      b. Check engine light
      c. Diagnostic charts
      d. Storage
      f. Erasing
      g. Scanner
   3. Locating system components
   4. Faulty components
   5. Service manual flow charts described
   6. Check engine light
      a. Purpose
      b. False alarms
   7. General use of manual information/specifications

Reference Materials:

Computerized Engine Controls, Volumes 1-4, Mitchell Manuals Inc.

A.V. Materials:

Filmstrips (2) ‘The Automobile On-Board Computer System’ - Prentice Hall Media
OTC computer scanner monitor
Complete computer system - computer, controls and sensors. General Motors Corp.

Related Activities:

1. Students will take comprehensive notes.
2. Students may bring in a car to scan a computer for relevant information.
3. Students will take Auto Computer II Exam.
Unit 15: Automotive Fuel Systems

Objectives:

The student will:

- Describe the five major components found in any auto fuel system.
- Compare and contrast the operation of a carburetor to that of fuel injection.
- Understand the need for today's electronically controlled systems vs. older mechanical systems.
- Be familiar with the diagnosis of fuel system problems and appreciate the need for special tools and manuals.

Content:

A. The Basic Fuel Delivery System
   1. Tank
   2. Vents
   3. Lines
   4. Pump
   5. Filter

B. The Carburetor
   1. Purpose
      a. Mix
      b. Regulate
      c. Atomize
   2. Operation
      a. Venturi principle
      b. Vacuum
   3. Circuits
      a. Idle
      b. Low speed
      c. High speed
      d. Choke
      e. Accelerator
   4. Main areas and parts
      a. Barrell
      b. Venturi
      c. Circuits
      d. Float
      e. Accelerator pump
      f. Throttle plate
g. Mixture screws  
h. Choke  
i. Needle and seat  
j. Metering rods

5. Overhaul and repair  
   2. Special cleaning acid  
   3. Gasket kit  
   4. Adjustments  
   5. Special tools

C. Fuel Injection Systems  
1. System pump, pressure and filters.  
   a. Locations  
   b. P.S.I.  
   c. Diagnosis  
   d. Special tools  
1. Throttle body injection  
   a. Pressure regulation  
   b. Injector(s)  
   c. Idle air passage  
   d. Overhaul  
   e. Electronic controls  
   f. Problems/symptoms  
3. Port fuel injection  
   a. Sequention  
   b. Non-sequential  
   c. Injectors  
   d. Problems/symptoms  
   e. Cold starting  
   f. Electronic controls  
   g. Air control body  
   h. Pressure regulation  
   i. Overhaul

D. Tuned Port Fuel Injection  
1. Purpose  
2. Design

E. Elimination of Many Emission Control Devices

Reference Materials:

Computerized Engine Controls Volumes 1-4 Mitchell Manuals Inc.
A.V. Material:

Video - 'Port Fuel Injection Systems' - Bergwall Production Inc.
Cardboard simulated model carburetor - O'Loskey
Complete fuel system components - pumps, filters, carbs, TBI injection & PFI injection. General Motors Corp.

Related Activities:

1. Students will take comprehensive notes.
2. Students will take the Auto Fuel Systems Exam.
Unit 16: Automotive Emission Devices

Objectives:
The student will:

- Understand the purpose/operation of all major emission control devices.
- Realize the consequences of removing any emission device.
- Be aware of the need for periodic maintenance of emission systems, and what is involved.

Content:

A. Review of Emission Pollutants

B. Evolution
   1. Late 1960's
   2. Original devices
      a. P.C.V.
      b. Thermae
      c. Transmission spark control
      d. Lean mixture

C. Effects on Engine Performance
   1. Negative
   2. Positive

D. Major Engine Design Modifications
   1. Cylinder heads
   2. Camshafts
   3. Fuel systems
   4. Low compression
   5. Clearances
   6. Material
   7. Bearings

E. Basic Controls Explained
   1. Catalytic converter
   2. Air pump
   3. E.G.R.
   4. Charcoal canister
   5. P.C.V.
   6. E.F.E.
   7. Coolant
   8. Timing
F. System Maintenance
   1. Cleaners
   2. Filters
   3. Scheduled replacement
   4. Symptoms and problems

Reference Books:
   Automotive Emission Control and Tune-up Procedures - Ignition Manufactures Institute

Related Activities:
   1. Students will take comprehensive notes.
   2. Students may bring in cars to service any area of emission control devices.
Unit 17: Automobile Drive Lines and Suspension

Objectives:

The student will:

- Describe the three adjustments involved in aligning the wheels on a car.
- Recognize a universal and constant velocity joint and understand their use.
- Identify the four different types of suspension systems used on automobiles.
- Diagnose suspension related problems and understand what is involved in their repair.

Content:

A. Front End Suspension Systems
   1. Standard coil
   2. McPherson strut
   3. Control arms
   4. Shock absorbers

B. Front End Steering Components
   1. Steering box
   2. Tie rods
   3. Control arms
   5. Pitman arms
   6. Ball joints
   7. Idler arms
   8. Stabilizers

C. Front End Alignment
   1. Caster
   2. Camber
   3. Toe in/out
   4. Places for adjustment

D. Rear Suspension Systems
   1. Coil
   2. Leaf
   3. Axle
   4. Stabilizer
   5. Air bag
   6. Control arm
   7. Standard shocks
E. Special tools
   1. Pickel fork
   2. Spring compressor
   3. Pitman puller
   4. Hammer

F. Drive Shafts and Axles
   1. Rear wheel drive
      a. Drive shaft single and multi-piece
      b. Universal joints
   2. Front wheel drive
      a. Inner c.v. joint
      c. Out c.v. joint
d. c.v. joint boots
   3. Problems and Symptoms

Reference Books:
   Auto Mechanics Fundamentals Chapters 13, 15, 16 & 17, Stockel
   Automotive Encyclopedia Toboldt & Johnson

A.V. Materials:
   Filmstrips (2) ‘The Front End Explained’ Bergwall Productions, Inc.
   Filmstrips (2) 'Front Wheel Drive' Bergwall Productions, Inc.
   Video 'Constant Velocity Joints' EIS Corp.
   Worn c.v. and universal joints - Dell's junk yard

Related Activities:
   1. Students will take comprehensive notes.
   2. Students may bring in any car to service the suspension system.
   3. Students will take the Auto Drive Line and Suspension Exam.