APPLIED MECHANICS 40/50

Description (Combined Course- 2 periods)
Applied Mechanics 40 introduces students to automobile servicing and the maintenance/repair field. Work is performed on operational vehicles. Complete overhaul, repair, servicing and troubleshooting of all automotive systems are undertaken. Emphasis is placed on practical hands-on learning. Applied Mechanics 50 is a continuation of Applied Mechanics 40 for the student who desires to further their experience in working on operational vehicles in a hands-on learning environment.

Course Overview

Course Objectives

Students should be able to:

- understand and apply practical technological methods to a hands-on approach to problem-solving.
- use safely and efficiently, the resources, processes, concepts, and tools of automotive mechanics.
- develop the ability to analyze and resolve problems through practical experiences.
- use advanced computer technology to analyze vehicle performance on operational vehicles.
- use advanced repair methods to repair operational vehicles.
- analyze and resolve electrical, mechanical and fuel system problems on operational vehicles.
- explain why proper diagnosis methods are important to engine repair.

Essential Questions

- What are the symptoms of engine mechanical, electrical, fuel and brake system problems?
- What knowledge, skills, and safety practices are required to diagnose and repair various automotive systems?
- How do computer and emission control systems play a role in vehicle performance?

Assessments

Common Assessments

- Hands-on work assessments
- Workbook assignments coordinated with subject matter

Skill Assessment –Hands-on Examples

- Oil Changes
- Tune-ups
- Mechanical Troubleshooting and Repair
- Electrical Troubleshooting and Repair
- Brake Systems
- Exhaust Systems
- Computer Systems
- Engine Repair
- Emission System Troubleshooting and Repair
- Drive Axle Replacement
- Emission Control System Troubleshooting and Repair

Content Outline

I. Unit 1 - Automotive Careers, ASE Certification/Safety Review & Service Information and Work Orders
II. Unit 2 - Computer System Service and Diagnosis
III. Unit 3 - Fuel Injection Diagnosis and

Standards

Connecticut State Technology Education standards have been met in the following areas:

- ***Automotive Technology***
- ***Transportation Technology***
- ***Pre-Engineering***

	Repair IV. Unit 4 - Starting System, Charging System and Ignition System Testing and Repair V. Unit 5 - Hybrid System Operation and Service VI. Unit 6 - Cooling System Testing, Maintenance and Repair VII. Unit 7 - Lubrication System Testing, Service and Repair VIII. Unit 8 - Emission Control System Testing, Service and Repair IX. Unit 9 - Engine Diagnostics, Service and Repair and Removal/Installation (Applied Mech. 50) X. Unit 10 - Front Drive Axle and Differential Diagnosis and Repair (Applied Mech. 50) XI. Unit 11 - Brake System Diagnosis and Repair & Anti-Lock Brake and Traction Control Diagnosis XII. Unit 12 - Electrical System and Accessories Diagnosis and Repair		

Pacing Guide											
1st Marking Period			2nd Marking Period			3rd Marking Period			4th Marking Period		
September	October	November	December	January		February	March	April		May	June
Unit 1 Automotive Careers, ASE Certification /Safety Review & Service Information and Work Orders 2 weeks	Unit 2 Computer System Service and Diagnosis 2.5weeks	Unit 3 Fuel Injection Diagnosis and Repair 2.5 weeks	Unit 4 Starting System, Charging System, and Ignition System Testing and Repair 2 weeks	Unit 5 Hybrid System Operation and Service 3 weeks	Unit 6 Cooling System Testing, Maintenance and Repair 2 weeks	Unit 7 Lubrication System Testing, Service and Repair 2 weeks	Unit 8 Emission Control System Testing, Service and Repair 3 weeks	Unit 9 Engine Diagnostics, Service and Repair and Removal/ Installation (Applied Mech. 50) 2 weeks	Unit 10 Front Drive Axle and Differential Diagnosis and Repair (Applied Mech. 50) 2 weeks	Unit 11 Brake System Diagnosis and Repair & Anti-Lock Brake and Traction Control Diagnosis 3 weeks	Unit 12 Electrical System and Accessories Diagnosis and Repair 6 weeks

Unit 1- Automotive Careers, ASE Certification/Safety Review & Service Information and Work Orders 2 weeks top

Standards

Automotive Technology

AUTO.02 Customer Relations and Shop Procedures: Explain the basic processes and procedures for maintaining a clean, safe and customer-friendly shop.

AUTO.02.01 AUTO.02.02 AUTO.02.03

AUTO.04 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.

AUTO.04.01 AUTO.04.02 AUTO.04. AUTO.04.04 AUTO.04.05

Unit Objectives

Students will be able to:

- develop an understanding of the responsibilities and requirements of a qualified automotive technician.
- develop skills required to use computer-based service information in solving part replacements and repairs.

Essential Question

- Why are procedures and practices of various manufacturers regarding repair and maintenance schedules to be followed?

Focus Questions

- What are some of the responsibilities and requirements for a qualified automotive technician?
- What are the most important ways to prevent shop accidents?
- What is the most efficient way to use computer-based service information to resolve repair problems?

Assessments

- Shop Projects
- Workbooks
- Generate Shop Repair Estimates

Skill Objectives

Students will:

- list the most common automotive careers.
- describe the skills needed to be an automotive technician.
- describe safe practices as an automotive technician.
- explain how to use computer-based service information.

Unit 2 – Computer System Service and Diagnosis, 2.5 weeks top

Standards

Automotive Technology

AUTO.05 Diagnosis and repair engines, including but not limited to two- and four-stroke and supporting subsystems

AUTO.05.03

AUTO.07 Engine Performance: Describe the components and functions of the various systems that are related to engine performance.

AUTO.07.04

Unit Objectives

Students will be able to:

- perform a visual inspection of the engine, its sensors, actuators, and the systems they monitor and control.
- diagnose a sensor or actuator problem.

Essential Question

- How have computerized engine controls impacted repair and maintenance of vehicles?

Focus Questions

- What should you look for during a preliminary inspection of a computer system?
- How do computer trouble help in the diagnosis of an engine performance problem?

Assessments

- Projects on working vehicles will include but not limited to:
  - Electrical Troubleshooting and Repair
  - Computer System Diagnosis
  - Emission Control System Diagnosis

Skill Objectives

Students will:

- replace sensors and actuators.
- test and diagnose automotive computer problems.

Unit 3 – Fuel Injection Diagnosis and Repair, 2.5 weeks top

Standards

Automotive Technology

AUTO.03 Explain scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.

AUTO.03.09

AUTO.07 Engine Performance: Describe the components and functions of the various systems that are related to engine performance.

AUTO.07.02

Unit Objectives

Students will be able to:

- diagnose typical gasoline injection system problems.
- perform necessary procedures to maintain, diagnose, service, and repair vehicle systems and malfunctions related to fuel systems.

Essential Question

- How do electronic fuel management systems impact vehicle reliability?

Focus Questions

- Where are the fuel pressure regulator, multi-port injection system and the throttle body located on the particular vehicle?
- What adjustments can be made the fuel injection system?

Assessments

- Projects on working vehicles will include but not limited to:
  - Fuel System Troubleshooting and Repair
  - Engine Problem Diagnosis and Repair

Skill Objectives

Students will:

- test, remove and replace fuel system component parts.
- use diagnostic equipment to test for fuel system problems.
- use service manuals when making basic adjustments on gasoline injection systems.

Unit 4 – Starting System, Charging System and Ignition System Testing and Repair, 2 weeks top

Standards

Automotive Standards

AUTO.06 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.
AUTO.06.01, AUTO.06.02, AUTO.06.03, AUTO.06.04

AUTO.07 Engine Performance: Describe the components and functions of the various systems that are related to engine performance.
AUTO.07.01

Unit Objectives

Students will be able to:

- maintain, diagnose, and repair electrical systems.
- describe the components and functions of the various electrical and electronic systems that are related to engine performance.

Essential Question

- How does an increased understanding of electricity and electronics impact the ability of an auto technician to perform diagnosis and repair?

Focus Questions

- What are the most common causes of a no-crank problem?
- What are the common problems associated with a charging system?
- How do you correct an ignition system problem?

Assessments

- Projects on working vehicles will include but not limited to:
  - Starting System Diagnosis and Repair
  - Charging System Diagnosis and Repair
  - Ignition System Diagnosis and Repair

Skill Objectives

Students will:

- remove and replace a starter motor if necessary.
- repair common starting problems.
- remove, test, repair, and replace an alternator, if necessary.
- repair charging system problems.
- test, remove and replace ignition system parts, as required.
- repair typical ignition system problems.

Unit 5– Hybrid System Operation and Service, 3 weeks top

Standards

Automotive Technology

AUTO.04 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.

AUTO.04.04

Transportation Technology

TRAN.02 Define transportation technology systems.

TRAN.02.08

Unit Objectives

Students will be able to:

- explain advantages and disadvantages of existing, new, and emerging systems in automobiles.
- explain the operational principles of hybrid drive systems and how they are impacting the environment.

Essential Question

- How does innovation in engineering impact the real world application of new and emerging technologies?

Focus Questions

- What are the advantages of a Hybrid vehicle?
- What safety precautions must be followed when working on a Hybrid vehicle?
- What types of problems can occur with a Hybrid drive system?

Assessments

- Projects on working vehicles will include but not limited to:
  - Electrical System Diagnosis and Repair
  - Drive System Diagnosis and Repair

Skill Objectives

Students will:

- diagnose problems with hybrid systems.
- remove and replace parts, as necessary.
- identify the major parts of a hybrid drive system.
- explain the construction and operation of hybrid drive assemblies.
- identify the most common problems that occur in a hybrid vehicle drive system.

Unit 6 – Cooling System Testing, Maintenance and Repair, 2 weeks top

Standards

Automotive Technology

AUTO.03 Explain scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.

AUTO.03.06

AUTO.05 Diagnosis and repair engines, including but not limited to two- and four-stroke and supporting subsystems

AUTO.05.01, AUTO.05.02

Unit Objectives

Students will be able to:

- describe and demonstrate the process for diagnosing and repairing cooling systems.
- explain scientific principles in relation to chemical, mechanical, and physical functions for cooling systems.

Essential Question

- How is an understanding of scientific principles related to diagnosis of cooling systems problems?

Focus Questions

- Under the hood, where would be the most common places to find leaks in a cooling system?
- What causes a car to overheat?
- How do you protect your cooling system and engine with proper maintenance repairs?

Assessments

- Projects on working vehicles will include but not limited to:
  - Cooling System Diagnosis and Repair
  - Heater System Diagnosis and Repair

Skill Objectives

Students will:

- remove, repair and replace cooling system components, as necessary.
- test cooling system for coolant levels and concentrations.
- check and replace all parts of the cooling system.
- describe the most common causes of system leakage and overheating.

Unit 7 – Lubrication System Testing, Service and Repair, 2 weeks top

Standards

Automotive Technology

AUTO.03 Explain scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
AUTO.03.06

AUTO.05 Diagnosis and repair engines, including but not limited to two- and four-stroke and supporting subsystems
AUTO.05.01, AUTO.05.02

Unit Objectives

Students will be able to:

- describe and demonstrate the process for diagnosing and repairing lubrication (organic vs. synthetic).
- maintain, diagnose, service, and repair lubrication systems.

Essential Question

- What role does proper lubrication play in the efficiency and longevity of engine life?

Focus Questions

- What are the main causes of engine lubrication problems?
- How does routine maintenance play an important role in the life of an engine?
- What type of oil and changing intervals are proper for a particular vehicle?

Assessments

- Projects on working vehicles will include but not limited to:
  - Lubrication System Diagnosis and Repair
  - Performing routine lubrication maintenance on a vehicle

Skill Objectives

Students will:

- describe lubrication system problems.
- diagnose lubrication system problems.
- change oil and filter systems.
- lubricate and check necessary parts.
- service an engine lubrication system.

Unit 8 – Emission Control System Testing, Service and Repair, 3 weeks top

Standards

Automotive Technology

AUTO.05 Diagnosis and repair engines, including but not limited to two- and four-stroke and supporting subsystems

AUTO.05.03

AUTO.07 Engine Performance: Describe the components and functions of the various systems that are related to engine performance.

AUTO.07.03

Unit Objectives

Students will be able to:

- explain the impact of emission control systems on the environment.
- maintain, diagnose, and repair computerized engine control systems and other engine-related systems.

Essential Question

- How have emissions control systems impacted the environment?

Focus Questions

- What are the main causes of emission control problems?
- How do emission control problems affect an engines performance?
- What is the difference between a sensor and an actuator?

Assessments

- Projects on working vehicles will include but not limited to:
  - Electrical Troubleshooting and Repair
  - Computer System Diagnosis
  - Emission Control System
  - Diagnosis and Repair

Skill Objectives

Students will:

- inspect and troubleshoot emission control systems.
- test, remove or replace emission control components, as necessary.
- use hand held scanner to diagnose emission control problems.

Unit 9 – Engine Diagnostics, Service and Repair and Removal/Installation (Applied Mech 50), 2 weeks top

Standards

Automotive Technology

AUTO.03 Explain scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
AUTO.03.09, AUTO.01.05

AUTO.05 Diagnosis and repair engines, including but not limited to two- and four-stroke and supporting subsystems
AUTO.05.01, AUTO.05.02, AUTO.05.03

Unit Objectives

Students will be able to:

- describe symptoms of engine mechanical problems.
- summarize specific engine disassembly and reassembly procedures.
- perform general engine maintenance, diagnosis, service, and repair in accordance with portable national industry standards.

Essential Question

- How does a knowledge of vehicle systems and how they operate enable an accurate diagnosis of a problem?

Focus Questions

- What are the specific symptoms of engine mechanical problems?
- What procedures and safety precautions are required prior to removing an engine?
- What specific procedures must be followed when installing an engine?

Assessments

- Projects on working vehicles will include but not limited to:
  - Engine Troubleshooting and Repair
  - Engine Service
  - Engine Removal and Install

Skill Objectives

Students will:

- diagnose and repair specific engines, as necessary.
- perform engines tests to isolate problems as necessary.
- remove, repair and replace an engine, if necessary.
- perform specific engine disassembly and reassembly procedures.

Unit 10 – Front Drive Axle and Differential Diagnosis and Repair (Applied Mech 50), 2 weeks top

Standards

Automotive Technology

AUTO.09 Demonstrate function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with portable national industry standards.

AUTO.09.07, AUTO.09.09

Unit Objectives

Students will be able to:

- demonstrate function and principles of automotive drivetrain.
- describe the function and operation of front drive axles and differentials.
- maintain, diagnose, service, and repair under-vehicle systems and malfunctions related to front drive axles and differentials.

Essential Question

- How do mechanical drive systems transfer power utilizing multiple links to transfer force?

Focus Questions

- What are the typical symptoms of front drive axle problems?
- What is involved with repairing or replacing a front cv axle?
- How do you check and replace gear oil in a transaxle or differential?

Assessments

- Projects on working vehicles will include but not limited to:
  - Front Drive Axle Troubleshooting and Repair
  - Differential Diagnosis and Repair

Skill Objectives

Students will:

- diagnose common transaxle and drive axle problems.
- diagnose common differential problems.
- remove and replace Front CV drive axles, as necessary.
- check, change and repair gaskets on transaxles and differentials, as necessary.

Unit 11– Brake System Diagnosis and Repair, Anti-Lock Brake and Traction Control Diagnosis, 3 weeks top

Standards

Automotive Technology

AUTO.09 Demonstrate function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with portable national industry standards.

AUTO.09.01, AUTO.09.02, AUTO.09.03, AUTO.09.04, AUTO.09.05, AUTO.09.06

Unit Objectives

Students will be able to:

- describe hydraulic systems as they pertain to the service braking system.
- describe the components of power assist braking systems.
- describe and demonstrate the process for diagnosing and repairing braking systems.

Essential Question

- What role does fluid dynamics play in hydraulic braking systems?

Focus Questions

- What are come brake problems associated with a vehicle?
- What is the proper procedure to replace disc and drum brakes?
- What is the purpose of anti-lock brakes?
- How do traction control and stability control systems help in the controlling a vehicle?

Assessments

- Projects on working vehicles will include but not limited to:
  - Brake System Diagnosis and Repair
  - Anti-Lock Brake System Diagnosis and Repair
  - Traction Control System Diagnosis and Repair

Skill Objectives

Students will:

- diagnose common brake problems.
- bleed a hydraulic brake system, as necessary.
- diagnose and repair a vehicle's disc or drum brake system, as necessary.
- inspect and repair anti-lock brakes, traction control, and stability control systems, as necessary.

Unit 12 – Electrical System and Accessories Diagnosis and Repair, 6 weeks top

Standards

Automotive Technology

AUTO.06 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.

AUTO.06.01, AUTO.06.02, AUTO.06.03, AUTO.06.04

Unit Objectives

Students will be able to:

- demonstrate the function, principles, and operation of electrical and electronic systems.
- maintain, diagnose, and repair electrical systems.
- describe and demonstrate the process for performing battery diagnosis and service.

Essential Question

- Why is it important to be able to apply Ohm's Law in the diagnosis and repair of electrical systems?

Focus Questions

- What is involved with diagnosing a vehicle electrical problem?
- What electrical components, wiring, and fuses need to be checked in diagnosing an electrical problem?
- What type of connectors are required when splicing wires?
- What is Ohm's Law?

Assessments

- Projects on working vehicles will include but not limited to:
  - Electrical System Diagnosis and Repair
  - Electrical Accessories Diagnosis and Repair

Skill Objectives

Students will:

- diagnose problems with light, instrumentation and accessories.
- read wiring diagrams to install and repair electrical components.
- troubleshoot and perform electrical repairs on vehicles with problems, as necessary.
- test, remove and replace electrical components, as necessary.
- use solder and solderless connectors to perform wire splicing repairs, as necessary.
- use a voltmeter to diagnose vehicle electrical problems.