

# **AUTOMOTIVE TECHNOLOGY IV**

**Course # 1093**

**Credits 17.5**

**September 2017**

## **I. COUSE DESCRIPTION:**

Passaic County Technical Institute's automotive program is a National Automotive Technicians Educational Foundation (NATEF) Certified program, which offers students instruction in all the basic areas of automotive technology. It provides a sound educational building foundation for the students with a strong interest in the automotive industry including a description of trade requirements and an insight into the automotive employment opportunities. Occupational and personal safety and health will be emphasized at all levels. Automotive Technology IV is the last of three full year courses that will follow National Institute for Automotive Service Excellence (ASE), Maintenance and Light Repair (MLR) training program. A minimum of 540 hours of combined classroom and lab/on-vehicle service and repair activities will be completed by the end of the fourth year. Additionally, NATEF policy on its task list serves as a basis for course completion. Which is: Ninety-five percent (95%) of Priority 1 (P-1); eighty percent (80%) of Priority 2 (P-2); and fifty percent (50%) of Priority 3 (P-3) will be taught. The task-based curriculum teaches industry standards so that the student can have a smooth transition to the work environment. The emphasis during this year is Engine Performance; Heating, Ventilation, and Air Conditioning (HVAC); Diagnostics of Engine Performance tasks.

The students will perform routine scheduled maintenance services to the vehicles. On-vehicle service and repair work is scheduled to benefit the students and supplement ongoing instruction on items specified in the NATEF task list. Students will have had instruction and practice on specific repair tasks prior to on-vehicle service and repair work. The primary source of on-vehicles for service and repair will include but not limited to vehicles donated by manufacturers, customer-owner vehicles, training student-owner vehicles and other vehicles. Industry-type completed work orders will be on or attached to all vehicles to be serviced.

**II. UNITS:**



**PASSAIC COUNTY TECHNICAL INSTITUTE**  
**45 Reinhardt Road**  
**Wayne, NJ**

**Career and Technical Education Curriculum Unit Planner**

**UNIT 1**

<b>Content Area:</b>	<b>AUTOMOTIVE TECHNOLOGY IV</b>	<b>Grade(s)</b>	<b>12</b>
<b>Unit Plan Title:</b>	<b>Safety</b>		
<b>NJSLS/CCTC Standard(s) Addressed in this unit</b>			
<p>8.1.5. E.1a Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.</p> <p>9.3. ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.</p> <p>9.3.ST.3 Describe the following safety, health, and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.</p> <p>9.3ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.</p> <p>9.3.ST-ET.5 Apply knowledge in Stem to solve problems</p> <p>3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p> <p>3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p> <p>3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.</p> <p>MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.</p> <p>CRP1. Act as a responsible and contributing citizen and employee.</p> <p>CRP2. Apply appropriate academic and technical skills.</p>			

- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence

### **Essential Questions (3-5)**

- Why is it important to follow safe practices in the workplace and how do shop policies, procedures, and safety inspections make the workplace safer ?
- How does the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA) impact the workplace?
- What is the difference between a shop policy and a shop procedure?
- How are hazardous environments identified and what safety precautions should be taken in hazardous environments?
- What are some common workplace safety signs and what are their meanings?
- What are some standard safety equipment items that should be in the workplace?
- How is a safe level of air quality in the workplace maintained and how is toxic dust managed
- What are some safety precautions to be taken when working with electrical tools and equipment?
- How can the shop layout contribute to efficiency and safety?
- How can the risk of fires in shop be reduced and how is firefighting equipment used?
- How are Safety Data Sheets (SDS) used?
- How is engine oil and fluids properly managed?
- What is the proper use and procedures for safe lift operations?
- What is the proper use and placement of floor jacks and jack stands?
- What are and does one properly use fender covers and floor mats?
- How are vehicles properly prepared for customer pickup?

### **Anchor Text**

Fundamentals of Automotive Maintenance and Light Repair, by Kirk T. VanGelder and Ian W. Andrew, Jones & Bartlett, Burlington, MA, 01803, 2015, ISBN# 978-1-284-05673-0

Fundamentals of Automotive Maintenance and Light Repair Student Workbook, Kirk T. VanGelder, Jones & Bartlett, Burlington, MA, 01803, 2016, ISBN# 978-1-284-07783-4

Fundamentals of Automotive Maintenance and Light Repair Tasksheet Manual for NATEF Proficiency, Kirk T. VanGelder, Jones & Bartlett, Burlington, MA, 01803, 2016, ISBN# 978-1-284-07785-8

### **Short & Informational Texts (3-5)**

Auto Upkeep: Basic Car Care, Maintenance, and Repair 3<sup>rd</sup> Edition, by Michael E. Gray and Linda E. Gray, Rolling Hills Publishing , Ozark Missouri, 2013, ISBN# 978-1-62702-006-0

Auto Upkeep: Basic Car Care, Maintenance, and Repair Workbook 3<sup>rd</sup> Edition, by Michael E. Gray and Linda E. Gray, Rolling Hills Publishing , Ozark Missouri, 2013, ISBN# 978-1-62702-002-2

Modern Automotive Technology 8<sup>th</sup> edition, by James E. Duffy, The Goodheart-Willcox Company, Inc., Tinley Park, IL., 2014, ISBN# 978-1-61960-370-7

### **Expected Proficiencies of the Unit**

#### **Shop and Personal Safety:**

Identify general shop safety rules and procedures.

Utilize safe procedures for handling of tools and equipment.

Identify and use proper placement of floor jacks and jack stands.

Identify and use proper procedures for safe lift operations.

Utilize proper ventilation procedures for working within the lab/shop area.

Identify marked safety areas.

Identify the location and the types of fire extinguishers and other fire safety equipment; demonstrate knowledge of the procedures for using fire extinguishers and other fire safety equipment.

Identify the locations of eyewash stations.

Identify the locations of the posted evacuation routes.

Comply with the required use of safety glasses, ear protection, gloves, and shoes during lab/shop activities.

Identify and wear appropriate clothing for lab/shop activities.

Secure hair and jewelry for lab/shop activities.

Demonstrate awareness of the safety aspects of supplemental restraint systems (SRS), electronic brake control systems, and hybrid vehicle high voltage circuits.  
 Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge (HID) lamps, ignition systems, injection systems, etc.).  
 Locate and demonstrate knowledge of material data sheets (MSDS).

**Formative & Summative Assessments**

Formative: quizzes ,task sheets completion, homework CDX on-line pre and post module assessments,  
 Summative: Tests both written and performance

**Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)**

[www.SP2.org/site/page/automotive](http://www.SP2.org/site/page/automotive)

**Suggested Time Frame:** 1 week

**Career and Technical Education Curriculum Unit Planner**

**UNIT 2**

<b>Content Area:</b>	<b>AUTOMOTIVE TECHNOLOGY IV</b>	<b>Grade(s)</b>	<b>12</b>
<b>Unit Plan Title:</b>	<b>HVAC</b>		
<b>NJSL/CCTC Standard(s) Addressed in this unit</b>			
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3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP9. Model integrity, ethical leadership and effective management.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence

### **Essential Questions (3-5)**

What are the principles of refrigeration and the four cycles of refrigeration?

What are the safety precautions observed when working on heating and air conditioning systems?

What is the interaction between the heating and air conditioning systems?

What is relative humidity and how does it affect the automotive heating and air conditioning system?

What are the three states of matter and what is the effect on the expansion and contraction of system parts because of heat generated during the use of the heating and air condition system?

What is the concept of heat transfer in terms of conduction, radiation, and convection in automotive systems?

How does one determine the proportion of variables of a solution and determine if that proportion is within the manufacture's specifications?

How are system temperatures measured and converted to degrees Fahrenheit or degrees Centigrade as required?

What is the scientific method and how is it used in the applied by an automotive technician?

Why is it important to be able to use standard and metric temperature measurement instruments to measure system temperatures and determine conformance to metric specification?

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### **MLR Proficiencies of the Unit**

#### **HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

**For every task in Heating, Ventilation and Air Conditioning (HVAC), the following safety requirement must be strictly enforced:**

**Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.**

#### **VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

##### **A. General**

1. Research vehicle service information, including refrigerant/oil type, vehicle service history, service precautions, and technical service bulletins. P-1

2. Identify heating, ventilation and air conditioning (HVAC) components and configuration. P-1

## **VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

### **B. Refrigeration System Components**

1. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; visually inspect A/C components for signs of leaks; determine necessary action. P-1

2. Identify hybrid vehicle A/C system electrical circuits and the service/safety precautions. P-2

3. Inspect A/C condenser for airflow restrictions; determine necessary action. P-1

## **VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

### **C. Heating, Ventilation, and Engine Cooling Systems**

1. Inspect engine cooling and heater systems hoses and pipes; determine necessary action. P-1

## **VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)**

### **D. Operating Systems and Related Controls**

1. Inspect A/C-heater ducts, doors, hoses, cabin filters, and outlets; determine necessary action. P-1

2. Identify the source of A/C system odors. P-2

<b>HA Tasks</b>	
P-1	6
P-2	2
P-3	0
	8

### **Formative & Summative Assessments**

Formative: quizzes ,task sheets completion, homework CDX on-line pre and post module assessments,

Summative: Tests both written and performance

### **Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)**

[www.SP2.org/site/page/automotive](http://www.SP2.org/site/page/automotive)

**Suggested Time Frame:** 6 weeks

## Career and Technical Education Curriculum Unit Planner

### UNIT 3

<b>Content Area:</b>	<b>AUTOMOTIVE TECHNOLOGY IV</b>	<b>Grade(s)</b>	<b>12</b>
<b>Unit Plan Title:</b>	<b>Engine Performance</b>		
<b>NJSLS/CCTC Standard(s) Addressed in this unit</b>			
<p>8.1.5. E.1a Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.</p> <p>9.3. ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.</p> <p>9.3.ST.3 Describe the following safety, health, and environmental standards related to science, technology, engineering and mathematics (STEM) workplaces.</p> <p>9.3ST-ET.3 Apply processes and concepts for the use of technological tools in STEM.</p> <p>9.3.ST-ET.5 Apply knowledge in Stem to solve problems</p> <p>3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.</p> <p>3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.</p> <p>3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.</p> <p>MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.</p> <p>CRP1. Act as a responsible and contributing citizen and employee.</p> <p>CRP2. Apply appropriate academic and technical skills.</p> <p>CRP3. Attend to personal health and financial well-being.</p> <p>CRP4. Communicate clearly and effectively and with reason.</p> <p>RP5. Consider the environmental, social and economic impacts of decisions.</p> <p>CRP6. Demonstrate creativity and innovation.</p> <p>CRP7. Employ valid and reliable research strategies.</p> <p>CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.</p>			

CRP9. Model integrity, ethical leadership and effective management.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence

### **Essential Questions (3-5)**

What are the basic principles of a modern ignition system and the functions of the major components in the system?

What are the various types of ignition systems?

What is the process involved in diagnosing ignition system issues and what are the steps involved in maintaining and repairing ignition system components; and what are some of the safety concerns of tasks related to ignition systems?

How can a coil increase the battery voltage needed to fire a spark plug and what is the role of the ignition coil transformer's in generating the high voltage required to fire a spark plug?

What are the principles of the gasoline fuel system and what are the characteristics of gasoline fuel?

What is the stoichiometric ratio and how is it applied to engine fuel; and what are the components of the fuel supply system?

What is the difference between single-point and multipoint injection systems?

What are the principles and components of the electronic fuel injection (EFI) fuel supply system?

What are volatile organic compounds (VOC) and how does it relate to vehicle emissions; what are some of the pollutants emitted by vehicles?

What are some of the various sensors of the EFI system?

What causes engine knock?

What are the origins and purpose of the on-board diagnostic (OBDI and OBDII) systems and why is it important to monitor on-board systems and report emission-related faults?

What is the role of controller area networks?

What is the purpose and function of diagnostic trouble codes (DTC's); and how do scan tools work and what is involved in using them?

What is the purpose and function of control modules such as the power train control module (PCM), the body control module (BCM), and the transmission control module (TCM)?

What is the relationship between barometric pressure to engine performance?

What are the basic principles of the intake and exhaust systems and their components; and how are tasks related to air induction and exhaust systems safely performed?

How is sound intensity measured; and how can listening for unusual sounds play part in the trouble shooting process?

How can the frequency of a sound be used to identify normal and abnormal operating sounds?

How can emissions from vehicles be reduced and what types of control devices are used?

What are the chemical reactions that occur in the automotive engine that are related to the combustion of fuels and the operation of the catalytic converter; and what are the principles by which a catalytic converter modifies emissions?

What is meant by “alternate fuel” and what are the three basic hybrid drive configurations?

### **Anchor Text**

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### **Short & Informational Texts (3-5)**

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Modern Automotive Technology 8<sup>th</sup> edition, by James E. Duffy, The Goodheart-Willcox Company, Inc., Tinley Park, IL., 2014, ISBN# 978-1-61960-370-7

### **Expected Proficiencies of the Unit**

**For every task in Engine Performance the following safety requirement must be strictly enforced:**

#### **Engine Performance**

**For every task in Engine Performance the following safety requirement must be strictly enforced:**

**Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage,**

**and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.**

## **VIII. ENGINE PERFORMANCE**

### **A. General**

1. Research vehicle service information, including fluid type, vehicle service history, service precautions, and technical service bulletins. P-1
2. Perform engine absolute manifold pressure tests (vacuum/boost); document results. P-2
3. Perform cylinder power balance test; document results. P-2
4. Perform cylinder cranking and running compression tests; document results P-2
5. Perform cylinder leakage test; document results P-2
6. Verify engine operating temperature. P-1
7. Remove and replace spark plugs; inspect secondary ignition components for wear and damage. P-1

## **VIII. ENGINE PERFORMANCE**

### **B. Computerized Controls**

1. Retrieve and record diagnostic trouble codes (DTC), OBD monitor status, and freeze frame data; clear codes when applicable. P-1
2. Describe the use of the OBD monitors for repair verification. P-1

## **VIII. ENGINE PERFORMANCE**

### **C. Fuel, Air Induction, and Exhaust Systems**

1. Replace fuel filter(s) where applicable. P-2
2. Inspect, service, or replace air filters, filter housings, and intake duct work. P-1
3. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; determine necessary action. P-1
4. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; determine necessary action. P-1

5. Check and refill diesel exhaust fluid (DEF).

P-2

**VIII. ENGINE PERFORMANCE**

**D. Emissions Control Systems**

1. Inspect, test, and service positive crankcase ventilation (PCV) filter/breather, valve, tubes, orifices, and hoses; perform necessary action.

P-2

EP Tasks	
P-1	8
P-2	7
P-3	0
	15

**Formative & Summative Assessments**

Formative: quizzes ,task sheets completion, homework, CDX on-line pre and post module assessments

Summative: Tests both written and performance

**Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)**

[www.SP2.org/site/page/automotive](http://www.SP2.org/site/page/automotive)

**Suggested Time Frame:** 11 weeks

**Career and Technical Education Curriculum Unit Planner**

**UNIT 4**

<b>Content Area:</b>	<b>AUTOMOTIVE TECHNOLOGY IV</b>	<b>Grade(s)</b>	<b>12</b>
<b>Unit Plan Title:</b>	<b>Diagnostics of Engine Performance</b>		
<b>NJSLS/CCTC Standard(s) Addressed in this unit</b>			
8.1.5. E.1a Use digital tools to research and evaluate the accuracy of, relevance to, and appropriateness of using print and non-print electronic information sources to complete a variety of tasks.			
9.3. ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance.			
9.3.ST.3 Describe the following safety, health, and environmental standards related to science, technology, engineering and			

mathematics (STEM) workplaces.

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9.3.ST-ET.5 Apply knowledge in Stem to solve problems

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MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

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CRP6. Demonstrate creativity and innovation.

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CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP9. Model integrity, ethical leadership and effective management.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence

### **Essential Questions (3-5)**

What are the basic principles of a modern ignition system and the functions of the major components in the system?

What are the various types of ignition systems and what is the process involved in diagnosing ignition system issues?

What are some of the safety concerns of tasks related to ignition systems; and what are the steps involved in maintaining and repairing ignition system components?

How can a coil increase the battery voltage needed to fire a spark plug and what is the role of the ignition coil transformer's in generating the high voltage required to fire a spark plug?

What are the principles of the gasoline fuel system and what are the characteristics of gasoline fuel?

What is the stoichiometric ratio and how is it applied to engine fuel; and what are the components of the fuel supply system?

What is the difference between single-point and multipoint injection systems; and what are the principles and components of the electronic fuel injection (EFI) fuel supply system?

What are volatile organic compounds (VOC) and how does it relate to vehicle emissions; and what are some of the pollutants emitted by vehicles?

What are some of the various sensors of the EFI system?

What causes engine knock?

What are the origins and purpose of the on-board diagnostic (OBDI and OBDII) systems and why is it important to monitor on-board systems and report emission-related faults?

What is the role of controller area networks?

What is the purpose and function of diagnostic trouble codes (DTC's); and how do scan tools work and what is involved in using them?

What is the purpose and function of control modules such as the power train control module (PCM), the body control module (BCM), and the transmission control module (TCM)?

What is the relationship between barometric pressure to engine performance?

What are the basic principles of the intake and exhaust systems and their components; and how are tasks related to air induction and exhaust systems safely preformed?

How does sound generated in one place carry to other parts of the vehicle body or engine through metal and materials; and how is sound intensity measured?

How can listening for unusual sounds play part in the trouble shooting process; and how can the frequency of a sound be used to identify normal and abnormal operating sounds?

How can emissions from vehicles be reduced and what types of control devices are used?

What are the chemical reactions that occur in the automotive engine that are related to the combustion of fuels and the operation of the catalytic converter; and what are the principles by which a catalytic converter modifies emissions?

What is meant by "alternate fuel" and what are the three basic hybrid drive configurations?

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### Expected Proficiencies of the Unit

#### VIII. ENGINE PERFORMANCE

##### A. General: Engine Diagnosis

1. Identify and interpret engine performance concerns; determine necessary action. P-1
2. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. P-1
3. Diagnose abnormal engine noises or vibration concerns; determine necessary action. P-3
4. Diagnose the cause of excessive oil consumption coolant consumption, unusual exhaust color, odor, and sound; determine necessary action. P-2
5. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. P-1
6. Perform cylinder power balance test; determine necessary action. P-2
7. Perform cylinder cranking and running compression tests; determine necessary action. P-1
8. Perform cylinder leakage test; determine necessary action. P-1
9. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action. P-2
10. Verify engine operating temperature; determine necessary action. P-1
11. Verify correct camshaft timing. P-1

## **VIII. ENGINE PERFORMANCE**

### **B. Computerized Controls Diagnosis and Repair**

- |  |     |
|--|-----|
| 1. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. | P-1 |
| 2. Access and use service information to perform step-by-step (troubleshooting) diagnosis                                | P-1 |
| 3. Perform active tests of actuators using a scan tool; determine necessary action.                                      | P-2 |
| 4. Describe the importance of running all OBDII monitors for repair verification.  | P-1 |

## **VIII. ENGINE PERFORMANCE**

### **C. Ignition System Diagnosis and Repair**

- |   |     |
|---|-----|
| 1. Diagnose (troubleshoot) ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action. | P-2 |
| 2. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action.   | P-1 |
| 3. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram as necessary.   | P-3 |
| 4. Remove and replace spark plugs; inspect secondary ignition components for wear and damage.   | P-1 |

## **VIII. ENGINE PERFORMANCE**

### **D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair**

- |   |     |
|---|-----|
| 1. Check fuel for contaminants; determine necessary action.   | P-2 |
| 2. Inspect and test fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action. | P-1 |
| 3. Replace fuel filter(s).  | P-1 |
| 4. Inspect, service, or replace air filters, filter housings, and intake duct work.                                     | P-1 |
| 5. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.      | P-2 |

- |  |     |
|--|-----|
| 6. Inspect and test fuel injectors.  | P-2 |
| 7. Verify idle control operation.  | P-1 |
| 8. Inspect integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shields; perform necessary action. | P-1 |
| 9. Inspect condition of exhaust system hangers, brackets, clamps, and heat shields; repair or replace as needed.   | P-1 |
| 10. Perform exhaust system back-pressure test; determine necessary action.   | P-2 |
| 11. Check and refill diesel exhaust fluid (DEF).   | P-3 |

### VIII. ENGINE PERFORMANCE

#### E. Emissions Control Systems Diagnosis and Repair

- |   |     |
|---|-----|
| 1. Diagnose oil leaks, emissions, and driveability concerns caused by the positive crankcase ventilation (PCV) system; determine necessary action.                              | P-3 |
| 2. Inspect, test, and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.                            | P-2 |
| 3. Diagnose emissions and driveability concerns caused by the exhaust gas recirculation (EGR) system; determine necessary action.   | P-3 |
| 4. Inspect, test, service, and replace components of the EGR system including tubing, exhaust passages, vacuum/pressure controls, filters, and hoses; perform necessary action. | P-2 |
| 5. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.  | P-3 |

- |   |     |
|---|-----|
| 6. Inspect and test catalytic converter efficiency.   | P-2 |
| 7. Inspect and test components and hoses of the evaporative emissions control system; perform necessary action.                       | P-1 |
| 8. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control systems; determine necessary action. | P-3 |

EP Tasks	
P-1	19
P-2	12
P-3	7
	38

<b>Formative &amp; Summative Assessments</b>	
Formative: quizzes ,task sheets completion, homework ,CDX on-line pre and post module assessments Summative: Tests both written and performance	
<b>Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)</b>	
<a href="http://www.SP2.org/site/page/automotive">www.SP2.org/site/page/automotive</a>	
<b>Suggested Time Frame:</b>	18 Weeks

### III. Instructional Strategies:

The Automotive Department incorporates an Experiential Learning Environment simulating a modern automotive dealership. Teacher examples of work ethics and habits, cooperative learning and teacher evaluation accent classroom lessons. Lectures are reinforced with the use of web-based automotive curricula; smartboards, modern testing and diagnostic equipment, vehicle components and actual vehicles supplement and enhance classroom instruction. Reinforcement of lessons are complemented with active student participation in a functioning automotive repair lab. Students are expected to demonstrate proficiency of associated NATEF Task lists as well as effective communication skills incorporating applied academics such as science, technology, language arts, analytical and math skills as tasks are completed.

### IV. Scope and Sequence:

#### SAFETY

#### VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

##### A. General

#### VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

##### B. Refrigeration System Components

#### VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

##### C. Heating, Ventilation, and Engine Cooling Systems

VII. HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

D. Operating Systems and Related Controls

VIII. ENGINE PERFORMANCE

A. General: Engine Diagnosis

VIII. ENGINE PERFORMANCE

B. Computerized Controls Diagnosis and Repair

VIII. ENGINE PERFORMANCE

C. Ignition System Diagnosis and Repair

VIII. ENGINE PERFORMANCE

D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair

VIII. ENGINE PERFORMANCE

E. Emissions Control Systems Diagnosis and Repair

**IV. Complete List of Course Textbooks, Instructional Resources & Software**

Fundamentals of Automotive Maintenance and Light Repair, by Kirk T. VanGelder and Ian W. Andrew, Jones & Bartlett, Burlington, MA, 01803, 2015, ISBN# 978-1-284-05673-0

Fundamentals of Automotive Maintenance and Light Repair Student Workbook, Kirk T. VanGelder, Jones & Bartlett, Burlington, MA, 01803, 2016, ISBN# 978-1-284-07783-4

Fundamentals of Automotive Maintenance and Light Repair Tasksheet Manual for NATEF Proficiency, Kirk T. VanGelder, Jones & Bartlett, Burlington, MA, 01803, 2016, ISBN# 978-1-284-07785-8

Auto Upkeep: Basic Car Care, Maintenance, and Repair 3<sup>rd</sup> Edition, by Michael E. Gray and Linda E. Gray, Rolling Hills Publishing, Ozark Missouri, 2013, ISBN# 978-1-62702-006-0

Auto Upkeep: Basic Car Care, Maintenance, and Repair Workbook 3<sup>rd</sup> Edition, by Michael E. Gray and Linda E. Gray, Rolling Hills Publishing, Ozark Missouri, 2013, ISBN# 978-1-62702-002-2

Modern Automotive Technology 8<sup>th</sup> edition, by James E. Duffy, The Goodheart-Willcox Company, Inc., Tinley Park, IL., 2014, ISBN# 978-1-61960-370-7

## **V. Student Handout :**

### Course Description

Passaic County Technical Institute's automotive program is a National Automotive Technicians Educational Foundation (NATEF) Certified program, which offers students instruction in all the basic areas of automotive technology. It provides a sound educational building foundation for the students with a strong interest in the automotive industry including a description of trade requirements and an insight into the automotive employment opportunities. Occupational and personal safety and health will be emphasized at all levels. Automotive Technology IV is the last of three full year courses that will follow National Institute for Automotive Service Excellence (ASE), Maintenance and Light Repair (MLR) training program. A minimum of 540 hours of combined classroom and lab/on-vehicle service and repair activities will be completed by the end of the fourth year. Additionally, NATEF policy on its task list serves as a basis for course completion. Which is: Ninety-five percent (95%) of Priority 1 (P-1); eighty percent (80%) of Priority 2 (P-2); and fifty percent (50%) of Priority 3 (P-3) will be taught. The task-based curriculum teaches industry standards so that the student can have a smooth transition to the work environment. The emphasis during this year is Engine Performance; Heating, Ventilation, and Air Conditioning (HVAC); Diagnostics of Engine Performance tasks.

The students will perform routine scheduled maintenance services to the vehicles. On-vehicle service and repair work is scheduled to benefit the students and supplement ongoing instruction on items specified in the NATEF task list. Students will have had instruction and practice on specific repair tasks prior to on-vehicle service and repair work. The primary source of on-vehicles for service and repair will include but not limited to vehicles donated by manufacturers, customer-owner vehicles, training student-owner vehicles and other vehicles. Industry-type completed work orders will be on or attached to all vehicles to be serviced.

Proficiencies- Upon successful completion of the requirements of this course,

The student will be able to:

- A. Apply orientation procedures and shop rules.
- B. Develop proper attitudes concerning safety in the automotive shop and practice safety rules.
- C. Properly use common shop tools and equipment.
- D. Apply and demonstrate proper use of various types of service publications.
- E. Demonstrate proper procedure for filling out a repair order.
- F. Apply service and diagnostic procedures for engines.
- G. Apply service and diagnostic procedures for cooling systems.
- H. Diagnose and service starting and charging systems
- I. Describe and explain electrical / electronic systems theory including, gauges, warning devices, driver information, horns and wipers, and accessories.
- J. Apply service and diagnostic procedures for electrical / electronic systems including gauges, warning devices, driver information, horns and wipers, and accessories.
- K. Demonstrate engine performance theory and system operations.
- L. Apply service and diagnostic procedures for computerized engine controls, ignition systems, fuel, air induction, and exhaust systems, and emission control systems.
- M. Apply and demonstrate proper use of hand held test equipment including a DVOM, MODIS and VERUS Scanners, fuel pressure tester and other types of test and diagnostic equipment.
- N. Demonstrate proper safety procedures and theory for alternative fuel vehicles.

P-1  
VIII.  
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Engine  
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P-2

## **VIII. ENGINE PERFOR**

### **A. General: Engine Diag**

1. Identify and interpret
2. Research applicable v  
service precautions, and te
3. Diagnose abnormal e  
action.
4. Diagnose the cause of  
exhaust color, odor, and so
5. Perform engine absol  
necessary action.
6. Perform cylinder pow
7. Perform cylinder cran  
action.
8. Perform cylinder leak
9. Diagnose engine mee  
determine necessary action
10. Verify engine operati
11. Verify correct camsha

## **VIII. ENGINE PERFORMANCE**

### **B. Computerized Control**

1. Retrieve and record freeze frame data
2. Access and use scan tools (troubleshooting)
3. Perform active tests of engine
4. Describe the importance of

## **VIII. ENGINE PERFORMANCE**

### **C. Ignition System Diagnosis**

1. Diagnose (troubleshoot) hard starting, engine misfire, mileage, and emissions control
2. Inspect and test crankshaft action.
3. Inspect, test, and/or reprogram module; reprogram as necessary
4. Remove and replace spark wear and damage.

## **VIII. ENGINE PERFORMANCE**

### **D. Fuel, Air Induction, and**

1. Check fuel for contaminants
2. Inspect and test fuel pressure and volume; perform necessary
3. Replace fuel filter(s).
4. Inspect, service, or replace

5. Inspect throttle body, vacuum leaks and/or unmetered air.
6. Inspect and test fuel injection system.
7. Verify idle control operation.
8. Inspect integrity of the exhaust system, including converter(s), resonator(s), and muffler(s).
9. Inspect condition of exhaust system; repair or replace as needed.
10. Perform exhaust system leak test.
11. Check and refill diesel engine oil.

## **VIII. ENGINE PERFORMANCE**

### **E. Emissions Control Systems**

1. Diagnose oil leaks, engine oil consumption, and crankcase ventilation (PCV) system.
2. Inspect, test, and service air filter, air cleaner, cap, valve, tubes, orifices, and hoses.
3. Diagnose emissions and air recirculation (EGR) system.
4. Inspect, test, service, and replace air filter, tubing, exhaust passages, and hoses; perform necessary action.
5. Inspect and test electronic fuel injection systems; perform necessary action.
6. Inspect and test catalytic converter.
7. Inspect and test computerized engine control system; perform necessary action.

8. Interpret diagnostic trouble codes (DTCs) related to emissions control systems.

P-2

P-2

P-3

P-2

P-1

P-1

P-1

P-1

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