PATERSON PUBLIC SCHOOLS

Preparing All Children for College and Career

Department of College and Career Readiness

Automotive II

5.0 Credits

Unit Three

PATERSON PUBLIC SCHOOLS
Preparing All Children for College and Career

Automotive II

Course Description

This course will introduce students to the operational and automotive component systems focusing on the power-plant and transmission. Specifically but not restricted to fuel, intake, exhaust, ignition and automatic and manual transmission systems. Practical application of safe work habits and the correct use of tools and precision test instruments will be throughout the course. In addition, to meet the needs of changing technology, this program offers students the opportunity to master the necessary skills to pass the Automotive Service Excellence Certification (ASE) examination.

PATERSON PUBLIC SCHOOLS
Preparing All Children for College and Career

Automotive II

Pacing Guide		
Unit	**Topic**	**Suggested Timing**
Unit 1	Automotive Engine Repair	approx. 9 weeks
Unit 2	Automotive Engine Repair Phase II	approx. 10 weeks
Unit 3	Automotive Wheel Tire and Suspension	approx. 8 weeks
Unit 4	Automotive Brake Service	approx. 8 weeks

Educational Technology Standards

8.1.12.A.1, 8.1.12.B.2, 8.1.12.C.1, 8.1.12.D.1, 8.1.12.E.1, 8.1.12.F.1

- **Technology Operations and Concepts**
  - Create a personal digital portfolio, which reflects personal and academic interests, achievements, and career aspirations by using a variety of digital tools and resources.

- **Creativity and Innovation**
  - Apply previous content knowledge by creating and piloting a digital learning game or tutorial.

- **Communication and Collaboration**
  - Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.

- **Digital Citizenship**
  - Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.

- **Research and Information Literacy**
  - Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.

- **Critical Thinking, Problem Solving, Decision Making**
  - Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

Career Ready Practices

Career Ready Practices describe the career-ready skills that all educators in all content areas should seek to develop in their students. They are practices that have been linked to increase college, career, and life success. Career Ready Practices should be taught and reinforced in all career exploration and preparation programs with increasingly higher levels of complexity and expectation as a student advances through a program of study.

CRP1. **Act as a responsible and contributing citizen and employee**
Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

CRP2. Apply appropriate academic and technical skills.
Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

CRP3. Attend to personal health and financial well-being.
Career-ready individuals understand the relationship between personal health, workplace performance and personal well-being; they act on that understanding to regularly practice healthy diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

CRP4. Communicate clearly and effectively and with reason.
Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice, and organization, and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

CRP5. Consider the environmental, social and economic impacts of decisions.
Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization.

CRP6. Demonstrate creativity and innovation.
Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

CRP7. Employ valid and reliable research strategies.
Career-ready individuals are discerning in accepting and using new information to make decisions, change practices or inform strategies. They use reliable research process to search for new information. They evaluate the validity of sources when considering the use and adoption of external information or practices in their workplace situation.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

CRP9. Model integrity, ethical leadership and effective management.
Career-ready individuals consistently act in ways that align personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the directions and actions of a team or organization, and they apply insights into human behavior to change others' action, attitudes and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morals and organizational culture.

CRP10. Plan education and career paths aligned to personal goals.
Career-ready individuals take personal ownership of their own education and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the education and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

CRP11. Use technology to enhance productivity.
Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring new technology. They are proficient with ubiquitous technology applications. They understand the inherent risks-personal and organizational-of technology applications, and they take actions to prevent or mitigate these risks.

CRP12. Work productively in teams while using cultural global competence.
Career-ready individuals positively contribute to every team, whether formal or informal. They apply an awareness of cultural difference to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.

Differentiated Instruction

Strategies to Accommodate Students Based on Individual Needs

Time/General	Processing	Comprehension	Recall
• Extra time for assigned tasks • Adjust length of assignment • Timeline with due dates for projects • Communication system between home and school • Provide notes/outline	• Extra Response time • Have students verbalize steps • Repeat, clarify or reword directions • Mini-breaks between tasks • Provide a warning for transitions • Work partners	• Precise step-by-step directions • Short manageable tasks • Brief and concrete directions • Provide immediate feedback • Small group instruction • Emphasize multi-sensory learning	• Teacher-made checklist • Use visual graphic organizers • Reference resources to promote independence • Visual and verbal reminders • Graphic organizers
Assistive Technology	**Tests/Quizzes/Grading**	**Behavior/Attention**	**Organization**
• Computer/whiteboard • Audio Rercorder • Spell-checker • Audio-taped books	• Extended time • Study guides • Shortened tests • Read directions aloud	• Consistent daily structured routine • Simple and clear classroom rules • Frequent feedback	• Individual daily planner • Display a written agenda • Note-taking assistance • Color code activities

Enrichment

Strategies Used to Accommodate Based on Students Individual Needs:

- Adaption of Material and Requirements
- Evaluate Vocabulary
- Elevated Activity Complexity
- Additional Projects
- Independent Student Options
- Projects completed individual or with Partners
- Self Selection of Project
- Tiered/Multilevel Projects
- Learning Centers
- Individual Response Blog
- Independent Studies of Manuals
- Open-ended Projects
- Community/Subject expert mentorships

Assessments

Suggested Formative/Summative Classroom Assessments

- Graphic Organizers
- Teacher-created Unit Assessments, Chapter Assessments, Quizzes
- Systematic Skills assessment
- Accountable Talk, Oral Report, Think Pair, and Share
- Projects, Portfolio,
- Homework
- Schematic Mapping
- Photo, Video problem solving analysis
- NATEF task sheets
- NATEF end of program exams

Interdisciplinary Connections

English Language Arts
- Journal writing
- Close reading of Automotive-related content
- Create a brochure for a Auto industry
- Keep a running word wall of Automotive vocabulary

Social Studies
- Research the history of a given Automotive Industry
- Research prominent historical individuals in Automotive Industry
- Use historical references to solve problems

World Language
- Translate Automotive/Transportation-content
- Create a translated index of Automotive vocabulary
- Generate a translated list of words and phrases related to workplace safety

Math
- Research Automotive occupation salaries for a geographic area and juxtapose against local cost of living
- Go on a geometry scavenger hunt within Automotive repair shop
- Track various data, such as Transportation's impact on the GDP, career opportunities or among individuals currently occupying Automotive careers

Fine & Performing Arts
- Create a poster advertising your Automotive Repair Shop
- Design a flag or logo to represent your shop

Science
- Research the environmental impact of Automotive industry
- Research latest developments in automotive technology
- Investigate automotive applicable-careers in STEM fields

New Jersey Student Learning Standards

9.3– Career and Technical Education

TRANSPORTATION, DISTRIBUTION & LOGISTICS CAREER CLUSTER

- 9.3.12.TD.1: Describe the nature and scope of the Transportation, Distribution & Logistics Career Cluster and the role of transportation, distribution and logistics in society and the economy.
- 9.3.12.TD.2: Describe the application and use of new and emerging advanced techniques to provide solutions for transportation, distribution and logistics problems.
- 9.3.12.TD.3: Describe the key operational activities required of successful transportation, distribution and logistics facilities
- 9.3.12.TD.4: Identify governmental policies and procedures for transportation, distribution and logistics facilities
- 9.3.12.TD.5: Describe transportation, distribution and logistics employee rights and responsibilities and employers' obligations concerning occupational safety and health.
- 9.3.12.TD.6: Describe career opportunities and means to achieve those opportunities in each of the Transportation, Distribution & Logistics Career Pathways.

Pathway: FACILITY & MOBILE EQUIPMENT MAINTENANCE (TD□MTN)/ TRANSPORTATION OPERATIONS (TD□OPS)

- 9.3.12.TD□MTN.1: Develop preventative maintenance plans and systems to keep facility and mobile equipment inventory in operation.
- 9.3.12.TD□MTN.2: Design ways to improve facility and equipment system performance.
- 9.3.12.TD□OPS.1: Develop and evaluate transportation plans to move people and/or goods to meet customer requirements.
- 9.3.12.TD□OPS.2: Analyze performance of transportation operations in order to improve quality and service levels and increase efficiency.

Common Career Technical Core (CCTC)

Career Cluster Education & Training

TD 01 – Describe the nature and scope of the Transportation, Distribution & Logistics Career Cluster and the role of transportation, distribution and logistics in society and the economy.

- TD 01.3 – Identify the major modes of transportation and their role in society.

TD-MTN 1– Develop preventative maintenance plans and systems to keep facility and mobile equipment inventory in operation.

- TD-MTN 01.1 – Develop preventive maintenance plans and systems to meet equipment manufacturer requirements.
- TD-MTN 01.2 – Apply strategies used to monitor and evaluate the performance of maintenance plans and systems.

TD-MTN 2– Design ways to improve equipment performance.

- TD-MTN 02.1 – Develop plans for improving equipment performance.
- TD-MTN 02.2 – Execute repair plans for mobile equipment.
- TD-MTN 02.3 – Develop and execute repair plans based upon an assessment of the equipment inventory.

TD-HSE 1- Describe the health, safety and environmental rules and regulations in transportation workplace.

- TD-HSE 1.1 – Conduct audits and inspections and evaluate compliance with company policies and government laws and
- regulations.
- TD-HSE 1.3– Manage the ongoing implementation of health, safety and environmental policies, procedures and documentation
- systems including development of communication plans that promote and support the effort.

Common Core State Standards (CCSS)

CCSS - English-Language Arts

Key Ideas and Details:

- CCSS.ELA-LITERACY.RST.11-12.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure:

- CCSS.ELA-LITERACY.RST.11-12.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.

Integration of Knowledge and Ideas:

- CCSS.ELA-LITERACY.RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

Range of Reading and Level of Text Complexity:

- CCSS.ELA-LITERACY.RST.11-12.10 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Common Core State Standards (CCSS)

CCSS - Mathematics

Explain volume formulas and use them to solve problems:

- CCSS.MATH.CONTENT.HSG.GMD.A.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder.
- CCSS.MATH.CONTENT.HSG.GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.

Apply geometric concepts in modeling situations:

- CCSS.MATH.CONTENT.HSG.MG.A.1 Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder)
- CCSS.MATH.CONTENT.HSG.MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., BTUs per cubic foot).
- CCSS.MATH.CONTENT.HSG.MG.A.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost).

Reason quantitatively and use units to solve problems:

- CCSS.MATH.CONTENT.HSN.Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- CCSS.MATH.CONTENT.HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

Course: Automotive II **Unit:** III – Automatic and Manual Transmissions **Grade Level:** 9-12	**Unit Overview:** This course will introduce students to the operational and diagnostic phase of the automotive component systems. Primary focus Automatic Transmission, Manual Transmission and Transaxle analysis and repair. Practical application of safe work habits and the correct use of tools and precision test instruments will be throughout the unit. Understanding of intermediate to advanced automotive tools; safety practices and problem solving diagnostics are the essential next step in fulfilling the training that is needed for an automotive service career.
New Jersey Student Learning Standards (NJSLS): 9.3.12.TD.1, 9.3.12.TD.2, 9.3.12.TD.6	
Common Career Technical Core (CCTC): TD 01.3,TD-MTN 01.1, TD-MTN 01.2, TD-MTN 02.1,TD-MTN 02.2,TD-MTN 02.3	
Common Core State Standards (CCSS): RST.11-12.3; RST.11-12.4; RST.11-12.7; RST.11-12.10; HSG.GMD.A.1; HSG.GMD.A.3; HSG.MG.A.1; HSG.MG.A.2; HSG.MG.A.3; HSN.Q.A.1; HSN.Q.A.3	

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
Diagnose wheel/tire vibrations causing abnormal tire wear, suspension problems. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD.MTN.1, 9.3.12.TD.OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN	What information is necessary on customer information sheet to diagnose steering and wheel problems? What problems can arise from wheel misalignment? Suspension failure? What specialty tools are	• Diagnose wheel balance • Discuss types of tires • Discuss types of rims • Explain and demonstrate static balance • Explain and demonstrate dynamic balance Check for irregular wear • Check for physical	**Lab** Given a vehicle, service manual and necessary tools, inspect the suspension system components. All parts worn beyond manufacturer's specifications must be detected. **Lab #2**	**Suspension CAD Video** https://www.youtube.com/watch?v=LKqllf30mMY **Suspensions Systems** Double Wishbone Suspension - Explained https://www.youtube.com/watch?v=DsEmK1M87VQ

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	needed to assess suspension problems? Steering problems?	damage (cuts, etc.) • Check for radial and lateral run-out • Identify the different types of suspension systems • Demonstrate the proper procedure to inspect the suspension system • Describe shock absorber function • Identify steering linkage parts • Identify defective front and rear suspension assemblies	Given a vehicle with a vibration complaint and proper service manuals, troubleshoot the vehicle and make proper recommendation for repair.	
Diagnose steering problems and service and lubricate suspension, steering gear and linkage. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2	How are suspension components lubricated? What products are used in lubrication? What are the major components of the steering system? Suspension system?	• Demonstrate safety precautions while raising a vehicle on a hoist • Check tie-rod ends • Check idler arms, power steering gears including rack and pinion	**Lab** Given a vehicle with steering problems, proper service manual, and using information from customer complaint and a test drive, if possible, recommend the proper repair for the vehicle.	**YouTube** Understanding a Suspension System https://www.youtube.com/watch?v=nMQxqsyuJKE **YouTube** Power Steering Systems https://www.youtube.com/watch?v=Fkgp64e-nNQ

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
CCTC: TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	What systems need maintenance in regards to Suspension? Steering? How does the steering and suspension system affect tire wear?	• Check drag links • Describe "greased" joints versus "non-greasable" joints • Inspect and clean all fittings to be lubricated • Explain use of a lubricating chart for a specific vehicle • Demonstrate the lubricating equipment	**Checklist/Procedure** Develop Checklist/Procedure outlining steps to assess suspension and steering problems. .	
Inspect steering components including power steering fluid level and power steering pump drive belts. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1	How does power steering function? What are its main components? What special tools are used in service of steering components? What math skills are used in computing steering and suspension geometry? What special fluids and lubricants are used in	• Describe the differences among several types of fluids on the market that could • be used in the steering system • Identify power steering major parts • Describe method used to determine fluid level and fill to proper level • Inspect for power steering fluid leaks	**Lab** Given a vehicle, service manual and tools, remove and replace steering belt(s). Upon completion belt tension must be correct, belt must be properly aligned and adjusting bolts secured.	**YouTube** Power Steering Systems https://www.youtube.com/watch?v=Fkgp64e-nNQ **YouTube** How to Test and Troubleshoot a Power Steering Pump https://www.youtube.com/watch?v=4RRbFiro4ps

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
CCSS: RL.9-10.1; RI.9-10.5; SL.9-10.1	suspension and steering systems?	and any loose steering parts • Describe how belts are sized according to length, design and width • Demonstrate proper gauge tension on replaced belt (or hand method)		
Identify tires by types and sizes. Balance tires by computer, bubble, or spin then Rotate wheels and tires and torque lug nuts to specifications. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD□ MTN.1, 9.3.12.TD□ OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-	What are the primary differences between the major types of tires? How are tires checked for wear? What are problems associated with tire wear? What safety precautions are necessary when replacing tires and rims?	• Identify bias tires, radial and belted tires • Define aspect ratio • Discuss combination of belted, bias and radial tires • Diagnose tire pull; determine corrective action • Demonstrate safety precautions when vehicle is raised and wheels are removed • Demonstrate how to properly raise a vehicle to rotate the	**Lab** Given several tires, properly identify them by type and size. Given a tire that needs repair, repair the tire by properly dismounting, placing a patch on the inside and remounting the tire. **Presentation/Poster** Utilizing choice of medium provide the major types of tires.	**Coats Wheel Balancer** PDF Instructional Manual http://www.aescosc.com/pdfs/c_wb_950_1025_1050_1055op.pdf **Tire Rack** Tire Types 101 https://www.youtube.com/watch?v=XlVDfSmdfyI

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
10.5; SL.9-10.1		tires • Demonstrate proper handling of tire and hub caps and lug nuts while removed • from the vehicle • Explain need to check tire and wheel balance at this time • Demonstrate proper rotation of tires (bias ply or radial ply) • Define the terms "static" and "dynamic" balancing • Demonstrate locating position for wheel weights according to the type of balance • Demonstrate balancer available		
Service front wheel bearings, grease seals. Remove and replace front and rear wheel bearings, spindles and	What is the importance of wheel bearings? What is their function? How do we ascertain their optimum functionality?	• Explain what will happen if the wheel bearing is over tightened or under tightened	**Lab** Given a vehicle with defective front or rear wheel bearings, replace the bearings	**Steering system:** Steering Wheel System Animation https://www.youtube.com/watch?v=b0DKNIQFuzg

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
ball joints if necessary. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	What are the first signs of bad spindles and ball joints? What can happen if the spindles and ball joints fail? What type of lubricant is used for wheel bearings?	• Demonstrate proper removal, cleaning and grease packing of wheel bearings • Demonstrate replacement of bearings and seal • Demonstrate bearing adjustment and spindle nut locking procedure of hub • Discuss types of grease • Demonstrate proper bearing adjustment • Discuss the importance of not straightening or heating a bent steering spindle • Describe special tools needed to remove a spindle held by ball joints • Inspect all related parts (hub, bearings, backing plate, brake parts, etc.)	using the proper tools and service manuals, to manufacturer's specifications. **Venn Diagram** Illustrate the interdependence of the Wheels bearings and steering spindle and ball joints.	**Differentials:** Front wheel drive, steering and suspension https://www.youtube.com/watch?v=g0yxpgf0a5k

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
		• Demonstrate replacement of all related parts • Demonstrate removal of ball joints		
Engine block maintenance. Remove, clean, inspect and replace cylinder heads; inspect head for cracks and warpage. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	What is the engine block? How the pistons and engine block associated? Where are the cylinder walls located? What is glazing? Why is this important? What is a head gasket? What is its function?	• Explain head bolt torque sequence • Demonstrate use of torque wrench • Demonstrate removal of cylinder head and related components • Inspect cylinder head for warpage, cracks, burned valves, or other damage • Describe valve sealing, valve grinding, head milling or other related repairs • Identify intake and exhaust ports and explain their functions • Inspect water jacket • Describe front to rear head gasket coolant	**Lab** Given a vehicle with cylinder head malfunctions, service manual, necessary tools and equipment, remove and replace cylinder heads in accordance with manufacturer's procedure. All attaching hardware must be torqued and head gasket and manifolds must not leak. **Art Project** Poster illustrating a “cut-away” view of an engine.	**How It`s Made** Engine Block https://www.youtube.com/watch?v=wr4_B9EXWSo  **How It`s Made** Engine Pistons https://www.youtube.com/watch?v=dVLrAce8lHE

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
		passage hole • deglazing		
Remove and replace major suspension components: shock absorbers mountings and coil springs. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	Shocks represent what component of the suspension system? What are their function(s)? Coil Springs represent what component of the suspension system? What is their function? What safety precautions are necessary when working with compressed springs? What specialty tools are used?	• Explain the difference among standard, heavy duty and special purpose shock absorbers • Describe two purposes of shock absorbers • Demonstrate torque of shock absorber rubber grommets • Demonstrate test for operation and noise of shock absorber • Demonstrate the use of a spring compressor • Describe special tools needed to release ball joint connection • Demonstrate replacing and seating of replacement coil spring	**Lab** Given a vehicle, service manual and tools, remove and replace shock absorbers. **Lab #2** Given a vehicle with torsion bar suspension and proper service manual, measure and adjust height. **Inspection/Checklist** Create list correct procedure for removal and installation of shocks.	**Wiki How** How to Replace Shocks http://www.wikihow.com/Replace-Shocks **Ride Rite** Coil Spring Installation PDF http://riderite.com/-/media/www/riderite/files/Install Manuals/W237604101_RRInstallManual_EN.pdf

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
Remove and replace major suspension components: torsion bars, control arms, bushings. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	What is the relationship between torsion bars and control arms? What is their primary function? What role do the bushings play? Why is maintenance of these components important to a safe vehicle? What special tools are used in their replacement? Special safety procedures?	• Demonstrate safety procedures when working under a raised vehicle • Measure vehicle height to determine needed adjustments • Describe where to make adjustment, if not to specifications • Explain how the curb height can be adjusted on most torsion bar equipped vehicles • Demonstrate removal and replacement of torsion bar and curb height adjustment procedure • Describe several dangerous aspects of removing and replacing a control arm. • Demonstrate the use of a spring compressor	**Lab** Given a vehicle, service manual and necessary tools, remove and replace control arms and bushings. **Instructor for a Day** Outline lesson plan following lab safety procedures for replacing control arms/torsion bars. Present to class as teacher. **Math Exercise** Utilizing algebraic functions determine proper angles and heights for torsion bar and suspension components.	**How to Video** Torsion Bar Replacement- Nissan Xterra 4x4 https://www.youtube.com/watch?v=svpsYPrsB4E **Torsion Bar Replacement** Replacing a Torsion Bar on Porsche 944 http://www.clarks-garage.com/pdf-manual/susp-06.pdf

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
		• Describe special tools needed to release ball joint connection • Demonstrate replacing and seating of replacement coil spring		
Remove and replace/rebuild major suspension components: assembly. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	What is a MacPherson strut suspension? What are the major differences compared to a standard suspension? What special tools are utilized in working on this type of suspension? What special alignment tools are used to adjust the geometry of this type of suspension?	• Identify several cars that are MacPherson strut equipped and discuss the differences of such cars • Explain special tools used for safe operation • Identify a MacPherson strut assembly and explain its construction • Demonstrate removal of strut assembly and control of the coil spring • Demonstrate replacement of strut assembly and all	**Lab** Given a vehicle, service manual and proper tools, remove and replace the MacPherson strut assembly. All attachment hardware must be torqued to specifications, ride height must be correct and wheels must turn to their extremes without binding **Lab #2** Given a vehicle, service annual and proper tools, rebuild a MacPherson strut. Upon completion the strut must not bind, there should be no leaks, and	**Macpherson strut** How it works https://www.youtube.com/watch?v=EEMZ9vun2Y8 **MacPherson Strut** Disassemble and Reassemble Demonstration https://www.youtube.com/watch?v=9We7ilEfgMg

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
		related parts • Explain the advantages and/or disadvantages of a MacPherson strut as compared to other front end designs • Inspect unit to be disassembled for external damage • Demonstrate disassembly of strut and inspection of internal parts • Demonstrate assembly, installation and testing for operation of strut assembly	all snap rings and rubber boots should be secured.	
Remove and replace major steering components: Steering wheel, steering column, steering linkage, and mast jacket. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD□	What are the major components of the steering system? Why is the steering system one of the most important systems to keep in working order? What can occur if	• Test pressure in power steering systems • Identify all power steering units and explain functions • Demonstrate removal and replacement of	**Lab** Given a vehicle, service manual and proper tools, remove and replace hydraulic components in power steering system. Items to be included are steering gear, hose(s) and line(s),	**How a Car Works** How the Steering System Works http://www.howacarworks.com/basics/how-the-steering-system-works

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
MTN.1, 9.3.12.TD□ OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	steering components fail? What are the different types of steering systems? Power steering?	components selected for removal • Inspect for leakage and loose, worn or damaged parts • Flush, fill and bleed system • Diagnose variable-assist steering system • Diagnose, inspect, and adjust electronically-controlled steering systems • Demonstrate use of a steering wheel puller • Identify thread and bolt size on a specific vehicle so the appropriate puller can be used • Demonstrate proper removal and replacement of steering wheel and related parts • Demonstrate removal	steering cylinder, control valve and pump. When completed there should be no leaks, all attaching bolts should be secured, and all lines and hoses routed properly **Checklist** Develop checklist for addressing steering problems and solutions to fixing.	**Car Maintenance 101** Diagnosing Your Car's Steering Problems https://automechanics.wordpress.com/2008/10/14/car-maintenance-101-diagnosing-your-car%E2%80%99s-steering-problems-part-ii/

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
		and replacement of mast jacket • Demonstrate operational test of mast jacket and all related parts		
Check two wheel and four-wheel alignments. Define procedure for correct rear axle alignment. **NJSLS:** 9.3.12.TD.2, 9.3.12.TD.6, 9.3.12.TD MTN.1, 9.3.12.TD OPS.2 **CCTC:** TD-MTN 02.1, TD-MTN 02.2, TD-MTN 02.3,TD-HSE 1.1 **CCSS:** RL.9-10.1; RI.9-10.5; SL.9-10.1	What is 4-wheel alignment? What problems can occur without proper alignment? What systems does improper alignment affect? What special tools are needed to align all 4 wheels simultaneously?	• Demonstrate safety precautions while working under a vehicle • Define toe, caster, and camber • Identify adjustment points of the front end for toe, caster and camber setting • Describe tools and equipment necessary to align automobile front end • Demonstrate front end alignment procedure • Measure riding height; adjust as needed • Inspect tires; check	**Lab** Given a vehicle, service manual, necessary tools and equipment, align wheels. The toe, caster, and camber should meet manufacturer's specifications	

Student Learning Objectives (SLOs)	Essential Questions	Skills & Indicators	Sample Activities	Resources
		and adjust pressure • Check wheel, tire, and hub run out • Demonstrate safety precautions when working under a vehicle • Identify several cars that have an adjustable rear axle • Locate rear axle adjustment points • Demonstrate use of the equipment necessary to align the vehicle's rear axle		

Unit 3 Vocabulary	
Radial Steering linkage Tolerances Wheel balance Static balance Dynamic balance Tie-rod Idler arms Rack and pinion Drag links Steering gear Flex coupler Single action shocks Dual action shocks Belt tension Bias tires Belted tires Aspect ratio Tubeless tires	Bias ply Radial ply Wheel balancer Steering spindle Torsion bar Curb height Control arms Pitman arm Idler arm Steering knuckle MacPherson strut Mast jacket

Suggested Unit Projects *Choose At Least One*	
Writing Exercise Write a safety pamphlet outlining a safety procedure in the Lab	**Group Exercise** In a group create an action plan for improving safety in the Lab.

Suggested Structured Learning Experiences	
Youth and Adult Automotive Training Center in Newark 201 Bergen St, Newark, NJ 07103 https://www.google.com/webhp?sourceid=chrome-instant&ion=1&espv=2&ie=UTF-8 - q=Youth and Adult Automotive Training Center in Newark&tbs=lf:1,lf_ui:2&rflfq=1&rlha=0&rllag=40740789,-74189932,406&tbm=lcl&rldimm=1045171484867486717 Lincoln Tech 70 McKee Dr, Mahwah, NJ 07430 Phone: (201) 529-1414 Email: info@allairevillage.org http://www.lincolntech-usa.com/	Vintage Automobile Museum of New Jersey 1800 Bay Ave. Building #13 Point Pleasant, NJ Phone: 732-899-0012 http://www.vintageautomuseum.org/