Regional Occupational Program

NATEF Certification 2025-2026

Alignment, Brakes and Suspension

COURSE DESCRIPTON

This course is designed to meet NATEF and AYES standards for alignment, brakes, and suspension systems. Students that successfully complete this course will be prepared for ASE Certification testing. Upon successful completion of the course students should be able to obtain entry-level employment and/or continue their training at a postsecondary educational institution. The course includes practical experience and instruction in alignment, brake and suspension systems including all related components. The course also includes diagnostics and repair of alignment, brake and suspension systems including all related components. For additional information go to www.ctc.ca.gov.

Course Information:

Course Length:	2 Years
Prerequisite:	None
Course Level:	Capstone
UC:	No
Articulated:	No
Industry Cert.:	NATEF
Industry Sector:	Transportation
Pathway:	Systems Diagnostics, Service and Repair
CALPADS:	8532

O*Net SOC Codes:

49-3023	Automotive Service Technicians and Mechanics
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists

Legend:

CTE - PS	CTE Pathway Standards
CRP	Career Ready Practices
CTE - AS	CTE Anchor Standards
CCSS	Common Core State Standards
ISTE	International Society for Technology in Education

Includes updates from 24/25 Transportation Advisory

Advisory Minutes

NATEF Certification

Course Orientation

a. Discuss objectives for this course, including competencies, teacher expectations, classroom policies, and procedures.
b. Identify and discuss the acquisition of transferable skills (communication, collaboration, creativity, and critical thinking) and their importance to being college and career ready and for future personal and professional success.
c. Review objectives, competencies, and course syllabus.
d. Discuss student and teacher expectations including behavior, class rules, appropriate dress, pre-course knowledge, and grading policies, including enrollment and attendance requirements and procedures, and classroom/school safety and disaster procedures.
e. Discuss next steps in course sequence related to the career pathway, the need for reinforcement of basic skills, transferrable skills, and post-secondary and career options.
f. Discuss the Big Six: Career Ready Essentials and the Standards for Career Ready Practice as they relate to this course, all aspects of the industry sector, and being college and career ready.

Big Six: Career Ready Essentials

1. Effective Communication	CTE - PS	CRP	CTE - AS	CCSS	ISTE
a. Demonstrate effective verbal communication and conflict resolution skills. **b. Use the writing process to develop written communication with the appropriate tone, organization, and format for the identified audience.** c. Explain the effect of interpersonal skills on one's ability to communicate effectively and develop relationships. d. Describe the impact of ineffective communication on business relationships. e. Analyze the impact of vocabulary, body language, and tone on verbal communication. f. Demonstrate active listening skills. g. Accurately interpret industry-specific written communication. h. Model responsible and effective use of various communication technologies. i. Identify valid and reliable digital reference and resource materials. j. Gather information from multiple digital sources to compare and contrast, synthesize, and summarize. k. Identify and use appropriate communication and collaboration technologies. l. Utilize technology to problem solve, accomplish tasks, and to produce or publish products.		2 4 11	2 5 10	**LS** 9-10 11-12.6 **SLS** 11-12.2 9-10 11-12.1 11-12.1d **WS** 11-12.7 11-12.6	1b,c 2c 3b,c 5c 6b,c,d

2. Collaboration, Creativity, and Critical Thinking	CTE - PS	CRP	CTE - AS	CCSS	ISTE
a. Demonstrate critical thinking skills for a variety of purposes and in different settings. **b. Collaborate to reach consensus on an identical objective through the sharing of knowledge, tasks, and learning.** c. Discuss the importance of the critical thinking process to real-world applications. d. Evaluate the impact of creative thinking on problem solving and innovation in real-world applications.		5 9 10	5	**LS** 9-10 11- 12.6 **SLS** 9-10	1c 3c,d 4a-d 5c,d 6c 7b,c,d

e. Compile work that demonstrates the process used to (elaborate, refine, analyze) evaluate original ideas and maximize creative efforts. f. Apply divergent and convergent thinking to the development of an original idea or solution. g. Examine real-world limits to adopting ideas. h. Demonstrate creative thinking (preparation, insight, evaluation, elaboration, and communication) to create a new idea or concept. i. Assume shared responsibility for collaborative work, and value the individual contributions made by each team member. j. Evaluate evidence, arguments, claims, and beliefs to identify connections. k. Identify bias, prejudice, propaganda, self-deception, distortion, and misinformation. l. Produce intellectual, informational, or material products that serve an authentic purpose. m. Work effectively and respectfully with those from diverse backgrounds or cultures. n. Demonstrate respect, trust, commitment, and the ability to compromise in collaborative projects.				11-12.1 11-12.1d 11-12.2 **WS** 11-12.7 11-12.6	
3. Leaders and Teams: Roles and Responsibilities	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Determine the individual and team members' roles and responsibilities. **b. Demonstrate leadership skills and qualities (i.e., reliability, negotiation skills, initiative, positive reinforcement, recognition of others' efforts, problem-solving skills, conflict resolution, and delegation).** c. Explain the importance of technical, social, and communication skills to team success. d. Compare and contrast leadership styles and their effectiveness in various situations. e. Organize and delegate responsibilities in a team setting to encourage ideas, perspectives, and contributions from all team members. f. Develop a strong sense of team identity by brainstorming solutions, volunteering, assisting others, practicing respect and courtesy, and taking initiative. g. Examine situations in which a follower becomes the leader. h. Describe twenty-first-century skills required across all occupations. i. Identify and discuss the characteristics of a successful team (i.e., leadership, cooperation, and effective decision-making). j. Leverage social and cultural differences to increase innovation and quality of work.		7 9 10 12	5 7 9	**SLS** 11-12.2 9-10 11-12.1 11-12.1d **WS** 11-12.6	7a,c
4. Legal, Ethical, and Environmental Considerations	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Demonstrate industry specific ethical and legal practices. **b. Identify eco-friendly industry specific practices and resources.** c. Identify local, state, and federal regulatory agencies, entities, laws, and regulations. d. Identify discrimination based on race, nationality, religion, gender, age, disability, or sexual orientation. e. Summarize the ethical and legal implications of workplace discrimination and harassment.		7 8 9 12	4 8	**WS** 11-12.6 11-12.7 **SLS** 9-10	2a,b 3a,b 5c 6c

f. Explain the concept of corporate citizenship. g. Examine an employer's role in protecting the health and welfare of employees, the community, and the environment. h. Analyze current environmental laws and regulations and their impact on industry. i. Compare and contrast both society's and industry's impact on the environment.				11-12.1 11-12.1d 11-12.2	
5. Personal Growth and Career Planning	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Demonstrate continued personal development and growth. **b. Develop and manage a personal growth and career plan.** c. Explain the relationship between sound financial habits and financial security. d. Create and manage a personal financial plan. e. Demonstrate initiative in achieving personal and professional goals. f. Apply time management strategies to meet deadlines. g. Demonstrate a growth mindset through flexibility and a positive attitude. h. Select and demonstrate appropriate job-search and retention techniques. i. Demonstrate strategies to prepare for employment. j. Demonstrate interpersonal skills appropriate for the workplace. k. Elaborate on the importance of perseverance to personal and professional success. l. Discover personal career interests, aptitudes, and skills.		3	3	**LS** 9-10 11-12.6 **SLS** 9-10 11-12.1 11-12.1d 11-12.2 **WS** 11-12.6	1a 3a,c 4d 6a,d 7b
6. Workplace Safety and Personal Wellness	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Demonstrate proper industry specific safe work practices to prevent injury or illness. **b. Assess the potential impact of goal setting on personal and professional success.** c. Describe the role of security and emergency procedures in workplace safety. d. Describe the effect of preventative measures on emergencies in the workplace. e. Identify and describe the causes, prevention, and treatment of common accidents. f. Identify local, state, and federal agencies that regulate workplace safety. g. Explain the role of the California Occupational Safety and Health Administration (Cal-OSHA) and the Environmental Protection Agency (EPA). h. Discuss the basics of system operations. i. Demonstrate the proper use of personal protective equipment (PPE). j. Explain the purpose of and accurately interpret a Safety Data Sheet (SDS). k. Identify hazardous materials and chemicals. l. Demonstrate proper procedures to respond to work-related accidents and injuries. m. Describe how ergonomics, housekeeping, and maintenance are related to accidents and injuries. n. Demonstrate cyber ethics, cyber safety, and cybersecurity. o. Assess the potential impact of preventative physical and mental health measures on workplace safety.		6 12	4 6 9	**LS** 9-10 11-12.6 **WS** 11-12.7 11-12.6 **SLS** 9-10 11-12.1 11-12.1d	1a,d 2a-d 5b

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7. Steering Systems Liquids and Terminology	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Recognize steering system terminology and describe steering system fluids. **b. Define terms associated with steering systems such as friction, force, inertia, lever, speed, momentum, torque, power, and reduction.** c. Describe the characteristics of liquids associated with steering systems. d. Identify the fundamental laws of hydraulics and explain how they apply to the operation of a power steering fluid pump. e. Identify the fundamental laws of hydraulics and explain how they apply to the operation of non-rack and rack and pinion steering. f. List the components of an integrated non-rack and rack and pinion power steering gear and describe how it operates. g. Identify the components of an electronically controlled steering system. h. Diagnose, service, and repair steering and suspension systems.	C3.3 C6.2 C8.4	1 2 5	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	
8. Steering System Diagnostics and Service	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose and service automotive steering systems. **b. Inspect power steering fluid levels and condition.** c. Flush, fill, and bleed a power steering system. d. Identify and interpret suspension and steering concerns and take corrective action. e. Remove and reinstall a power steering pump pulley and check belt alignment. f. Inspect and replace power steering hoses and fittings. g. Perform power steering system pressure and flow tests. h. Research applicable service information steering systems and suspensions. i. Diagnose and repair as power steering gear problems such as binding, uneven turning, looseness, hard steering, and fluid leakage in non-rack and rack and pinion steering systems. j. Diagnose and repair electronically controlled steering systems.	C3.7 C8.4	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	
9. Steering System Linkage	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose and service steering system linkage and related components. **b. Inspect and replace as needed pitman arm, relay rod, idler arm, mountings, and steering linkage damper.** c. Inspect and replace as needed manual or power rack and pinion tie rod ends, tie rod sleeves, and clamps. d. Adjust as necessary front and rear steering linkage geometry including parallelism and vehicle ride height. e. Remove and replace manual or power rack and pinion steering gear and inspect mountings, bushings, and brackets.	C3.7 C8.2	1 5 11	1 5 11	**WS** 11-12.6	

f. Perform steering and suspension analysis and repairs.					
10. Rack and Pinion Steering Gear	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose, service, disassemble, and assemble a rack and pinion steering gear. **b. Remove and replace a manual or power rack and pinion steering gear.** c. Diagnose and repair or service as needed a manual or power rack pinion steering gear. d. Inspect and replace as needed bushings mountings and brackets.	C8.3 C8.4	1 5 11	1 5 11	**WS** 11-12.6	
11. Non-Rack and Pinion Steering	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose, service, disassemble, and assemble a non-rack and pinion steering gear. **b. Remove and replace a manual or power non-rack and pinion steering gear.** c. Diagnose and repair or service a manual or power non-rack and pinion steering gear. d. Inspect and replace bushings, mountings, and brackets. e. Adjust manual or power non-rack and pinion worm bearing and sector lash.	C8.3 C8.4	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	
12. Steering Columns	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Disassemble/assemble, diagnose, and service steering columns. **b. Describe the construction and operation of an energy absorbing steering column.** c. Disable and enable the supplemental restraint system. d. Remove and replace the steering wheel. e. Diagnose column noises looseness and binding concerns and determine the necessary corrective action. f. Inspect steering column components such as flexible couplings and collapsible columns.	C8.4	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	
13. Front Suspension Systems	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Describe the operation of front suspension systems. **b. Recognize and define the terms associated with the suspension system.** c. Compare and contrast the operation of short and long arm strut suspension systems. d. Explain the difference between a compression loaded and tension loaded ball joint. e. Describe the function of springs and explain Hooke's Law. f. Discuss shock absorber operation and related ratios. g. Identify different types of wheel bearings and explain how they operate.	C8.4	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	
14. Front Suspension System Components	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose, service, and repair front suspension components. **b. Locate and interpret component certification and calibration decals and labels.** c. Lubricate suspension and steering systems.	C8.4	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6	

d. Diagnose short and long arm suspension system noises, body sway, and uneven riding height concerns and determine necessary action. e. Remove and inspect or replace upper and lower ball joints on short and long arm suspension systems. f. Remove, inspect, and replace or adjust strut rods as needed. g. Remove, inspect, and replace stabilizer bar, bushings, brackets, and links as needed. h. Remove, inspect, and replace lower control arms, bushings, shafts, and rebound bumpers. i. Remove, inspect, and replace steering knuckle assemblies. j. Remove, inspect, and replace short and long arm suspension coil springs and spring insulators. k. Remove, inspect, and adjust suspension system torsion bars and mounts.				WS 11-12.6	
15. MacPherson Strut System	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose, disassemble, and service the MacPherson strut system. **b. Diagnose strut suspension system noises, body sway, and uneven riding height concerns and determine necessary action.** c. Remove, inspect, and install strut cartridge, strut coil spring, insulators and upper strut bearing mount.	C8.4 C8.6	1 5	1 5 11	WS 11-12.6	
16. Wheel Bearing	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose, disassemble, and service front and rear wheel bearings. **b. Diagnose and service front or rear wheel bearings.** c. Remove, inspect, and install front and rear wheel bearings.	C8.6	1 5	1 5 11	WS 11-12.6	
17. Rear Suspension System Components	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose, service, and repair rear suspension components. **b. Identify and describe the basic characteristics of a leaf control arm and strut type rear suspension systems.** c. Remove, inspect, and replace coil springs and spring insulators. d. Remove, inspect, and replace traverse links, control arms, bushings, and mounts. e. Remove, inspect, and replace leaf springs, leaf spring insulators, shackles, brackets, bushing and mounts. f. Remove, inspect, and replace MacPherson strut cartridge, coils spring and insulators.	C8.4 C8.6	1 2 5 11	1 2 5 11	LS 9-10 11-12.6 WS 11-12.6	
18. Electronic Suspension Systems	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Describe the operation of electronic suspension systems, diagnose and service their components. **b. Describe the operation of air adjusted shocks.**	C8.4 C8.6	1 2 5	1 2 5	LS 9-10 11-12.6	

c. Identify the components of a typical electronically controlled suspension system. d. Summarize the function of each component in a typical electronically controlled suspension system. e. Test and diagnose an electronically controlled suspension system using a scan tool and repair any incorrect operations.		11	11	**WS** 11-12.6	
19. Tires and Wheels	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Diagnose tire and wheel problems and service accordingly. **b. Explain how the terms motion, inertia, and momentum apply to wheels and tires.** c. Define the terms static balance, dynamic balance, tramping, and radial force variation. d. Identify the basic characteristics of the automobile tire. e. Describe the three basic types of passenger tire construction. f. Explain the types of tire ratings. g. Compare and contrast dynamic and static wheel balance. h. Explain automotive wheel and rim design. i. Determine the appropriate type of measurement to measure wheel, tire, axle, and hub runout to establish needed repairs. j. Diagnose tire wear problems and determine corrective action. k. Inspect tires and check air pressures. l. Rotate tires according to manufacturer's recommendations. m. Inspect and repair tires, as needed. n. Dismount and remount tires. o. Diagnose tire pull and determine necessary action. p. Balance a wheel and tire assembly using static and dynamic balancing systems. q. Diagnose wheel/tire vibration, shimmy, noise, and make any repairs to correct the problem.	C8.5	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	
20. Wheel Alignment and Steering Geometry	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Analyze the principles of wheel alignment, steering geometry, and a four-wheel alignment process. **b. Describe caster, camber, thrust angle, toe-in, and explain how those terms apply to wheels, steering and tires.** c. Summarize steering axis inclination. d. Describe angle turning radius, toe-out, and explain how those terms apply to steering geometry. e. Explain the difference between a two-wheel and four-wheel alignment. f. Differentiate between steering and suspension concerns using the principles of steering geometry. g. Diagnose vehicle wander, drift/pull, hard steering, steering return, and tire wear patterns.	C8.6	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	

h. Select the correct measurement type to measure caster, camber wheel toe, Ackerman angle, and determine any needed repairs. i. Use computerized and manual four-wheel alignment equipment to measure caster, wheel-toe, and Ackerman angles and determine any needed repairs. j. Perform pre-alignment inspection and adjust, as needed. k. Measure vehicle riding height and correct, as necessary. l. Check and adjust front and rear camber. m. Check and adjust front wheel toe. n. Center steering wheel. o. Check toe on turning radius and perform any needed corrective action. p. Check steering axis inclination and perform any needed corrective action. q. Check and adjust rear wheel toe. r. Check the rear wheel angle and determine the necessary action. s. Check front cradle (sub-frame alignment) and determine any necessary actions.					
21. AYES Work Journal	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Use AYES work journal and complete journal entries. **b. Complete work journal entries.** c. Employ strategy based diagnostic routines. d. Interpret and verify customer concerns. e. Interact with management, technicians, and customers. f. Utilize a diagnostic thought process with the OEM service manual. g. Reduce the possible causes of an electrical circuit problem with the electronic service information program. h. Recognize that a problem exists when there is a discrepancy between what is and what should or could be. i. Identify the reasons for the discrepancy. j. Implement a plan to correct the problem. k. Participate as an effective member of a dealership or business. l. Describe the role of a professional automotive technician and how effective communication contributes to the operation of the organization.	C4.0 C5.5 C7.0 C7.1	1 2 5 7 11	1 2 5 7 11	**LS** 9-10 11-12.6 **WS** 11-12.6 **SLS** 9-10 11-12.1	
22. Braking Systems	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Describe how the Laws of physics apply to the fundamental operation of a brake system and how the terms speed, work, torque, momentum, friction, energy, and power apply to automotive braking systems. **b. Describe friction, force, inertia, momentum speed, work, torque, and relate those terms to an automotive braking system.** c. Describe the effects of weight and speed on braking/stopping distance.	C8.3	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	

d. Analyze thermal expansion of fluids, gases, and solids. e. Explain how energy, temperature, and pressure affect automotive braking systems. f. Identify the thermodynamic principles that apply to automotive braking systems. g. Recognize the changes that occur when motion energy is converted to heat energy. h. Describe Newton's Laws of Motion and identify the concepts of mass, force, and acceleration that apply to automotive braking. i. Define the coefficient of friction. j. Interpret the operation of hydraulic brake systems. k. Interpret the operation of disc and drum brake systems. l. Diagnose, service, and repair disc brakes, drum brakes, antilock brakes, and other brake systems as developed.					
23. Introduction to Braking Systems	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Define specific terms related to disc and drum brakes, explain how the fundamental laws of hydraulics apply to automotive brake systems, identify types of power boosters, and describe the operation of anti-lock brakes. **b. Determine how the laws of hydraulics apply to automotive braking systems.** c. Identify the different types of master cylinders and explain their operation. d. Identify the different types of parking brakes and their components and describe the operation of each type of parking brake. e. Describe the operation of a split brake system. f. Identify foundation brake components and describe their function. g. List the types and components of power assist units and explain their operation. h. Recognize the components of an anti-lock brake system assist unit and describe how the system operates. i. Describe the function and basic operation of a microprocessor. j. Identify and describe the types of automotive input and output signals. k. Compare the types of wheel sensors used by anti-lock brake computers. l. Describe the uses of scanning equipment in communicating with anti-lock braking system computers. m. Explain the operation of a traction control system and identify its components. n. Define the characteristics of liquids. o. Spell out the properties of automotive brake fluids. p. Identify and define the terms associated with automotive brake fluids. q. Properly handle and store automotive brake fluids. r. Check and fill a brake fluid reservoir. s. Identify and define the terms associated with automotive brake bleeding. t. Bleed a manual, pressure, vacuum, and surge automotive brake system. u. Flush and refill a hydraulic brake system.	C8.3	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	

24. Brake System Schematics and Diagnosis	CTE - PS	CRP	CTE - AS	CCSS	ISTE
a. Read brake system schematics and utilize a process to diagnose brake system concerns. b. Identify and interpret brake system concerns. c. Research applicable vehicle and service information such as brake system operation, vehicle service history, service precautions, and technical service bulletins. d. Locate and interpret a calibration decal. e. Diagnose pressure concerns in the brake system using hydraulic principles from Pascal's Law. f. Diagnose poor stopping, pulling, or dragging caused by problems in the hydraulic system. g. Diagnose poor stopping, noise, pulling, grabbing, or pedal pulsation problems and determine necessary corrective action. h. Measure pedal height and adjust, as necessary. i. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, or wear and replace as needed. j. Check and tighten brake system fittings. k. Inspect, test, and replace components of the brake warning light system. l. Perform inspections and identify procedures for adjusting drum brake systems. m. Describe the procedure for visually inspecting disc brakes. n. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns and determine necessary action. o. Remove, clean, inspect, repack, and install wheel bearings, replace seals, and ensure that bearings are properly adjusted. p. Check parking brake cables for wear, rust, binding, corrosion, and clean, lubricate or replace as needed. q. Check the parking brake operation and correct any malfunctions. r. Inspect and replace wheel bearings. s. Inspect and replace wheel studs. t. Remove and reinstall a sealed wheel bearing assembly.	C8.3	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	

25. Hydraulic Components of Brake Systems	CTE - PS	CRP	CTE - AS	CCSS	ISTE
a. Identify faults via inspection of hydraulic components in the brake system and service master cylinders and wheel cylinders. b. Utilize appropriate safety procedures and guidelines. c. Check the master cylinder for proper operation, internal and external leaks, and determine any necessary corrective action. d. Remove, bench, bleed, and reinstall a master cylinder. e. Measure and adjust the master cylinder push rod length. f. Fabricate and/or install brake lines, such as double flare and ISO types and replace fittings and supports as needed.		1 2 5 6 11	1 2 5 6 11	**LS** 9-10 11-12.6 **WS** 11-12.6 **RSTS** 9-10 11-12.4	

g. Inspect, test, and replace metering (hold-off), proportional (balance), pressure differential, and combination valves. h. Inspect, test, replace, and adjust a load sensing proportioning valve. i. Check the operation of the brake light system and determine any necessary corrective action.					
26. Caliper and Rotor Service	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Disassemble calipers, refinish rotors, and define specific terms associated with the service and repair of brake disc calipers and rotors. b. Remove the caliper assembly from the mountings. c. Clean and inspect the caliper assembly for leaks and damage to the housing. d. Clean and inspect caliper mounting and slides for wear and damage to determine any necessary corrective action. e. Remove, clean, and inspect pads and retaining hardware. f. Dismantle and clean caliper assembly, inspect parts for wear, rust, scoring and damage, replace seals boots, and other damaged or worn parts. g. Reconstruct and reinstall the caliper assembly, pads, related hardware, seat pads, and inspect for leaks. h. Clean, inspect, and measure a rotor with a dial indicator and a micrometer following manufacturer's recommendations to determine the need to machine or replace. i. Remove and replace the rotor. j. Refinish rotor according to manufacturer's recommendations. k. Identify calipers that have an integrated parking brake system.	C8.6	1 2 5 11	1 2 5 11	**LS** 9-10 11-12.6 **WS** 11-12.6	
27. Drum Brake System Service	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Replace brake shoes and related hardware, refinish brake drums, and define specific terms associated with the service and repair of drum brake system. b. Use proper safety procedures to remove, clean inspect, and measure brake drums and replace, as needed. c. Refinish a brake drum. d. Remove, clean, and inspect brake shoes, springs, pins clips, levers, adjusters, and other brake related hardware including backing support plates. e. Lubricate and reinstall brake shoes, springs, pin clips, levers, adjusters, and other brake related hardware including backing support plates. f. Remove, inspect, and reinstall wheel cylinders. g. Preadjust brake shoes and parking brake before installing brake drums, hub assemblies, and wheel bearings. h. Install wheels, torque lug nuts and complete final checks and adjustments. i. Check the parking brake operation and determine any necessary corrective action.	C8.4	1 5 6 11	1 5 6 11	**WS** 11-12.6 **RSTS** 9-10 11-12.4	

28. Diagnosis of Power Assist Units	CTE - PS	CRP	CTE - AS	CCSS	ISTE
a. Perform diagnostics of power assist units and define specific terms associated with diagnostics and servicing of power-assist units including pneumatic and hydraulic boosters. b. Check pedal free travel with and without engine running and check power assist operation. c. Check the vacuum supply to vacuum-type power booster. d. Inspect a vacuum type of power booster unit for vacuum leaks and proper operation and determine any needed corrective action. e. Inspect and test a hydro-boost system/accumulator for leaks and proper operation and determine any needed corrective action.	C3.3 C8.1	1 5 11	1 5 11	**WS** 11-12.6	
29.Tires and Wheels	**CTE - PS**	**CRP**	**CTE - AS**	**CCSS**	**ISTE**
a. Perform diagnostics and service of common anti-lock braking systems and define specific terms associated with diagnostics and servicing of anti-lock braking systems. b. Observe anti-lock brake system warning lights at start-up and determine if further diagnosis is required. c. Diagnose poor stopping, wheel lock-up, abnormal pedal feel, or pulsation and noise concerns caused by the anti-lock brake and determine any needed corrective action. d. Diagnose anti-lock brake system electronic controls and components using self-diagnosis and recommended test equipment and determine any needed corrective action. e. Test, diagnose and service anti-lock brake system sensors, tone wheel, and circuits using a graphing multimeter and digital storage oscilloscope that includes output sign resistance, short to voltage/ground, and frequency data. f. Diagnose anti-lock brake system concerns caused by vehicle modifications such as tire size, curb height, and final drive ratio. g. Utilize accepted safety and service precautions when inspecting, testing, and servicing antilock brake system apparatus such as hydraulic, electrical, and mechanical components. h. Follow OEM recommended procedures for performing brake and anti-lock brake system tasks and comply with current regulations and standard operating practices. i. Inspect and test anti-lock brake system components for proper function and determine any necessary corrective action. j. Depressurize the high-pressure component of the anti-lock brake system. k. Bleed the anti-lock brake system's front and rear hydraulic circuits. l. Remove and reinstall anti-lock brake system's electrical/electronic components. m. Remove and reinstall anti-lock brake system's hydraulic components.	C8.3 C8.4	1 5 11	1 5 11	**WS** 11-12.6	

Standards Alignment

The curricula have been aligned with the CTE Model Curriculum Standards released in 2013. Each industry sector was updated to meet the increased rigor and relevancy requirements of the Common Core State Standards. The curriculum also includes the new Standards for Career Ready Practices.

Standards for Career Ready Practice

1. *Apply appropriate technical skills and academic knowledge.*
2. *Communicate clearly, effectively, and with reason.*
3. *Develop an education and career plan aligned with personal goals.*
4. *Apply technology to enhance productivity.*
5. *Utilize critical thinking to make sense of problems and persevere in solving them.*
6. *Practice personal health and understand financial literacy.*
7. *Act as a responsible citizen in the workplace and the community.*
8. *Model integrity, ethical leadership, and effective management.*
9. *Work productively in teams while integrating cultural and global competence.*
10. *Demonstrate creativity and innovation.*
11. *Employ valid and reliable research strategies.*
12. *Understand the environmental, social, and economic impacts of decisions.*

CTE Anchor Standards—Common Core English Language Arts Alignment

Anchor Standard 2: Communications

Language Standard: Acquire and accurately use general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the (career and college) readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. LS 9-10, 11-12.6

Anchor Standard 3: Career Planning and Management

Speaking and Listening Standard: Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SLS 11-12.2

Anchor Standard 4: Technology

Writing Standard: Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information.

Anchor Standard 5: Problem Solving and Critical Thinking

Writing Standard: 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, and synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WS 11-12.7

Anchor Standard 6: Health and Safety

Reading Standards for Science and Technical Subjects: Determine the meaning of symbols, key words, and other domain-specific words and phrases as they are used in a specific scientific or technical context. RSTS 9-10, 11-12.4

Anchor Standard 7: Responsibility and Flexibility

Speaking and Listening Standard: Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others' ideas and expressing their own clearly and persuasively. SLS 9-10, 11-12.1

Anchor Standard 8: Ethics and Legal Responsibilities

Speaking and Listening Standard: Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the work. SLS 11-2.1d

Anchor Standard 9: Leadership and Teamwork

Speaking and Listening Standard: Work with peers to promote civil, democratic discussions and decision making; set clear goals and deadlines; and establish individual roles as needed. SLS 11-12.1b

Anchor Standard 10: Technical Knowledge and Skills

Writing Standard: Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. WS 11-12.6

Anchor Standard 11: Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the industry-sector anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and the career technical student organization. Note: no alignment evident for this standard. WS 11-12.6

Transportation

C. Systems Diagnostics, Service, and Repair Pathway

C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.

C1.1 Know and understand common environmental conservation practices and their applications.

C1.2 Practice the safe handling and storage of chemicals and hazardous wastes in accordance with Material Safety Data Sheets (MSDS) and the requirements of local, state, and federal regulatory agencies.

C1.4 Use appropriate personal protective equipment and safety practices.

C1.5 Evaluate the advantages and disadvantages of existing, new, and emerging systems and the effects of those systems on the environment.

C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.

C2.1 Recognize the importance of calibration processes, systems, and techniques using various measurement and testing devices.

C2.3 Use tools, equipment, and machines to safely measure, test, diagnose, and analyze components and systems (e.g., electrical, and electronic circuits, alternating- and direct-current applications, fluid/hydraulic and air/pneumatic systems).

C2.5 Use measurement scales, devices, and systems, such as dial indicators and micrometers, to design, fabricate, diagnose, maintain, and repair vehicles and components following recommended industry standards.

C3.1 Describe the operating principles of internal and/or external combustion engines.

C3.2 Describe the function and principles of air-conditioning and heating systems.

C3.5 Practice the basic principles of electricity, electronics and electrical power generation, and distribution systems.

C3.7 Perform necessary procedures to maintain, diagnose, service, and repair vehicle systems and malfunctions.

C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.

C4.1 Communicate the procedures and practices of various manufacturers regarding service, repair, and maintenance schedules.

C4.2 Demonstrate how to properly document maintenance and repair procedures in accordance with applicable rules, laws, and regulations (e.g., Bureau of Auto Repair [BAR], Occupational Safety and Health Administration [OSHA], and the California Air Resources Board [ARB]).

C4.3 Use reference books, technical service bulletins, and other documents and materials related to the service industry available in print and through electronic retrieval systems to accurately diagnose and repair systems, equipment, and vehicles.

C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.

C6.1 Perform general engine maintenance, diagnosis, service, and repair in accordance with portable national industry standards, such as the National Automotive Technicians Education Foundation and the Equipment and Engine Training Council.

C6.2 Maintain, diagnose, service, and repair lubrication and cooling systems.

C6.4 Maintain, diagnose, service, and repair ignition, electronic, and computerized engine controls, and fuel management systems.

C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.

C7.1 Practice maintenance, diagnosis, and repair of electrical systems.

C7.2 Maintain, diagnose, repair, and service batteries.

C7.5 Diagnose, service, and repair heating and air-conditioning systems and components.

C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.

C8.2 Describe the function and operation of automatic and manual transmissions and transaxles.

C8.3 Diagnose, service, and repair disc brakes, drum brakes, antilock brakes, and other brake systems as developed.

C8.4 Diagnose, service, and repair steering and suspension systems.

C8.5 Interpret tire and rim sizing to select appropriate wheels and tires for vehicles.

C8.6 Maintain, diagnose, service, and repair under-vehicle systems and malfunctions.

ISTE Standards for Students

1. Empowered Learner- Students leverage technology to take an active role in choosing, achieving, and demonstrating competency in their learning goals, informed by the learning sciences.

a) Students articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.

b) Students build networks and customize their learning environments in ways that support the learning process.

c) Students use technology to seek feedback that informs and improves their practice and to demonstrate their learning in a variety of ways

d) Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies.

2. Digital Citizen- Students recognize the rights, responsibilities, and opportunities of living, learning, and working in an interconnected digital world, and they act and model in ways that are safe, legal, and ethical.

a) Students cultivate and manage their digital identity and reputation and are aware of the permanence of their actions in the digital world.

b) Students engage in positive, safe, legal, and ethical behavior when using technology, including social interactions online or when using networked devices.

c) Students demonstrate an understanding of and respect for the rights and obligations of using and sharing intellectual property.

d) Students manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.

3.Knowledge Constructor- Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts and make meaningful learning experiences for themselves and others.

a) Students plan and employ effective research strategies to locate information and other resources for their intellectual or creative pursuits.

b) Students evaluate the accuracy, perspective, credibility and relevance of information, media, data, or other resources.

c) Students curate information from digital resources using a variety of tools and methods to create collections of artifacts that demonstrate meaningful connections or conclusions.

d Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories, and pursuing answers and solutions.

4. Innovative Designer- Students use a variety of technologies within a design process to identify and solve problems creating new, useful, or imaginative solutions.

a) Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts, or solving authentic problems.

b) Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

c) Students develop, test, and refine prototypes as part of a cyclical design process.

d) Students exhibit a tolerance for ambiguity, perseverance, and the capacity to work with open-ended problems.

5. Computational Thinker- Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.

a) Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models, and algorithmic thinking in exploring and finding solutions.

b) Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.

c) Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.

d) Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

6. Creative Communicator- Students communicate clearly and express themselves creatively for a variety of purposes using platforms, tools, styles, formats, and digital media appropriate for their goals.

a) Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.

b) Students create original works or responsibly repurpose or remix digital resources into new creations.

c) Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models, or simulations.

d) Students publish or present content that customizes the message and medium for their intended audiences.

7. Global Collaborator- Students use digital tools to broaden their perspectives and enrich their learning by collaborating with others and working effectively in teams locally and globally.

a) Students use digital tools to connect with learners from a variety of backgrounds and cultures, engaging with them in ways that broaden mutual understanding and learning.

b) Students use collaborative technologies to work with others, including peers, experts, or community members, to examine issues and problems from multiple viewpoints.

c) Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.

d) Students explore local and global issues and use collaborative technologies to work with others to investigate solutions.