LAUSD UNIFIED Division of Adult and Career Education

Career Technical Education (CTE) Course Outline

Course Title:	Auto Tech: Brakes
Course Number:	79-90-54
Date:	July 2024
Industry Sector:	Transportation
Pathway:	Systems Diagnostics and Service
CBEDS Title:	Advanced Automotive
CBEDS Code:	5669
Credits:	10

Hours:

Total
150

Course Description:

This competency-based course provides students with technical instruction and practical experience in an area incorporating sustainable and green vehicle technologies. Instruction includes an introduction, safety – general, resource management, trade mathematics, tools and equipment, service manuals and computer-based information systems, general brake systems diagnosis, hydraulic system diagnosis and repair, drum brake diagnosis and repair, disc brake diagnosis and repair, power assist units diagnosis and repair, wheel bearings, parking brakes, electrical diagnosis and repair, electronic brake, antilock brake system, traction and stability control systems diagnosis and repair, employability skills and resume preparation, and entrepreneurial skills. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

Prerequisites:	Enrollment requires successful completion of Technology/1: Automotive Systems (79-90-83) and Technology/2: Automotive Systems (79-90-85) courses.
NOTE:	For Perkins purposes this course has been designated as a **capstone** course. This course **cannot** be repeated once a student receives a Certificate of Completion.
A-G Approval	N/A
Methods of Instruction:	Lecture and discussion, multimedia presentations, visual aids, projects individualized instruction, shop work
Student Evaluation:	Summative: End of section assessments
Industry Certification:	N/A
Recommended Texts:	Duffy, James E. Modern Automotive Technology, 10th Edition. Goodheart-Willcox Publishing, 2022. Johanson, Chris. Auto Brakes, 5th Edition. Goodheart-Willcox, 2021.
Link to Resource Folder	https://bit.ly/autotechbrakesresources Access to: Content Standards and resource links.

Approved by: Renny L. Neyra, Executive Director

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
A. INTRODUCTION Understand, apply, and evaluate classroom and workplace policies and procedures. (2 hours)	1. Discuss the scope and purpose of the course. 2. Discuss the classroom policies and procedures. 3. Discuss and demonstrate Zoom, Schoology, and basic computer skills. 4. Assess students' basic knowledge in brake principles. 5. Discuss, identify, research, and draw conclusions on the different career paths, occupations, employment outlook, and career advancements in the transportation industry sector which have an impact on vehicles. 6. Discuss the opportunities available for promoting gender equity and the representation of non-traditional populations in the automotive industry. 7. Explain and recognize the importance of ethics, teamwork, respecting individual and cultural differences and diversity in the workplace. 8. Describe the role of the Automotive Service of Excellence (ASE) as it applies to the automotive industry. 9. Describe the role of the Automotive Service Education Foundation (ASEF) in auto technician training.	**Career Ready Practice:** 1, 2, 3, 4, 5, 8, 9, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Career Planning & Management: 3.1, 3.4, 3.5, 3.6, 3.9 Technology: 4.1, 4.5 Problem Solving & Critical Thinking: 5.4 Ethics & Legal Responsibilities: 8.2, 8.3, 8.4, 8.5 Leadership & Teamwork: 9.3, 9.4, 9.6 Demonstration & Application: 11.1, 11.2 **CTE Pathway:** C2.6
B. SAFETY - GENERAL Understand safety procedures and techniques in the auto	1. Discuss classroom and workplace first aid, emergency procedures, and accidents or injury prevention. 2. Discuss the California Occupational Safety and Health Administration (Cal/OSHA) workplace	**Career Ready Practice:** 1, 2, 10, 12 **CTE Anchor:**

repair and maintenance sector. (3 hours)	requirements for auto technicians to maintain a safe and healthy working environment. 3. Discuss the impact of Environmental Protection Agency (EPA) legislation on Transportation Industry Sector practices in protecting and preserving the environment. 4. Describe and demonstrate ASEF standards regarding proper handling, storage and disposal of chemicals and materials used in an auto shop. 5. Discuss the impact of California Air Resources Board (ARB) legislation on the Transportation Industry Sector. 6. Discuss the Bureau of Automotive Repair (BAR) standards for consumer and environmental protection. 7. Discuss the use of the Safety Data Sheet (SDS) as it applies to the automotive industry. 8. Discuss the safety items required by the federal, state, and local regulations. 9. Discuss the importance of proper personal hygiene in the classroom and auto shop. 10. Describe and demonstrate the standards regarding proper use of protective equipment in an auto shop: a. clothing and gloves b. respiratory gear c. eye gear d. work shoes e. ventilation f. handling, storage, and disposal of chemicals and hazardous materials used in an auto shop g. proper use of tools and equipment 11. Practice personal safety when lifting, bending, or moving equipment and supplies. 12. Pass the safety test with 100% accuracy.	Academics: 1.0 Communications: 2.1, 2.3 Health & Safety: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7 Technical Knowledge & Skills: 10.2, 10.4 Demonstration & Application: 11.1 **CTE Pathway:** C1.2, C1.4, C2.2
C. RESOURCE MANAGEMENT Understand, apply, and evaluate the resource management principles and techniques in the auto repair and maintenance field.	1. Define and describe the benefits of the following: a. resources b. management c. sustainability d. profitability e. company growth 2. Describe and list specific examples of the effective management of the following resources in the auto shop repair and maintenance business: a. time b. materials	**Career Ready Practice:** 1, 2, 7 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3

(1 hour)	c. personnel 3. Pass a resource management assessment with an 80% score or higher.	Responsibility & Flexibility: 7.1, 7.4 Technical Knowledge & Skills: 10.1 **CTE Pathway:** C5.2
D. TRADE MATHEMATICS Understand, apply, and evaluate the mathematical requirements used in auto diagnosis, maintenance, and the repair field. (2 hours)	1. Define and identify the practical math terminology in auto repair and maintenance. 2. Describe, demonstrate, and ask questions regarding problem-solving techniques involving: a. basic trade mathematical operations b. changing fractions to decimals c. changing decimals to fractions d. engineering notation 3. Describe, demonstrate, and interpret the English and metric units of the measuring system and draw conclusions to make informed decisions. 4. Describe and demonstrate problem-solving techniques for: a. algebraic problems b. percentages c. reading and interpreting graphs d. calculator e. geometric problems that apply to auto repair and maintenance such as angles and degrees 5. Pass a trade mathematics assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 5, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 Problem Solving & Critical Thinking: 5,1, 5.2 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** C2.4
E. TOOLS AND EQUIPMENT Understand, apply, and evaluate the policies and procedures for using brake diagnostic, maintenance, and	1. Define, discuss, and demonstrate the proper use, maintenance, and storage techniques for the following specialty tools and equipment for brakes: a. bearing seal and race driver set b. brake bleeder, pressure, or vacuum c. brake disc micrometer d. brake drum micrometer and calibration equipment	**Career Ready Practice:** 1, 2, 10 **CTE Anchor:** Academics: 1.0 Communications:

repair tools and equipment. (6 hours)	e. brake lathe (bench with disc and drum service attachments) f. brake lathe (on car) g. brake shoe adjusting gauge h. brake spring remover/installer i. brake spring pliers j. brake spoon k. piston retraction set l. dial indicator m. wheel cylinder clamp holder 2. Explain and demonstrate the following: a. selection of the appropriate hand, power tools, and equipment for each job b. procedure for checking out hand, power tools, and equipment from the tool room c. safe use of the most common hand, power tools and equipment in the auto shop d. practice personal safety when lifting, bending, or moving equipment and supplies 3. Pass a tools and equipment assessment with an 80% score or higher.	2.1, 2.3 Health & Safety: 6.4 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.3
F. SERVICE MANUALS AND COMPUTER-BASED INFORMATION SYSTEMS Understand, apply, and evaluate the contents of service manuals and computer-based information systems as important sources of reference to an auto technician. (2 hours)	1. Identify the different types of service manuals. 2. State the different types of information that can be found in service manuals such as specifications, troubleshooting charts, and repair information. 3. Describe and demonstrate the use of service manuals. 4. Describe and demonstrate the use of web-based search engines in finding automotive technical information. 5. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. 6. Pass a service manual and computer-based information system assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 Technology: 4.1, 4.2 Demonstration & Application: 11.1 **CTE Pathway:** C2.6, C4.3, C4.4

G. GENERAL BRAKE SYSTEMS DIAGNOSIS Understand, apply, and evaluate the techniques for diagnosing the general brake systems according to the manufacturer's specifications. (12 hours)	1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. 2. Identify and interpret brake system concern; determine necessary action. 3. Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins. 4. Locate and interpret vehicle and major component identification numbers. 5. Pass a general brake systems diagnosis assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 Problem Solving & Critical Thinking: 5.3, 5.4 Technical Knowledge & Skills: 10.2 **CTE Pathway:** C2.1, C2.6, C4.1, C4.3, C4.4, C5.3, C8.3
H. HYDRAULIC SYSTEM DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for the brakes' hydraulic system according to the manufacturer's specifications.	1. Define Pascal's Law. 2. Diagnose pressure concerns in the brake system using hydraulic principles of Pascal's Law. 3. Measure brake pedal height, travel, and free play (as applicable); determine necessary action. 4. Check master cylinder for internal/external leaks and proper operation; determine necessary action. 5. Remove, bench bleed, and reinstall master cylinder. 6. Form teams to diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action. 7. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action. 8. Replace brake lines, hoses, fittings, and supports. 9. Fabricate brake lines using proper material and flaring procedures (double flare and ISO types).	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.3

(24 hours)	10. Select, handle, store, and fill brake fluids to the proper level. 11. Explain, inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves. 12. Inspect, test, and/or replace components of brake warning light system. 13. Explain and discuss the different types of brake fluids: a. DOT- 3 b. DOT- 4 c. DOT- 5 14. Explain the process to check and test brake fluid for contamination. 15. Discuss the different types of bleeding sequences and demonstrate how to bleed and/or flush brake system with: a. vacuum bleeding b. two-person bleeding c. gravity bleeding d. pressure bleeding 16. Pass a hydraulic system diagnosis and repair assessment with an 80% score or higher.	Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.3, C2.4, C2.5, C2.7, C3.3, C3.7, C4.1, C4.2, C8.1, C8.3
I. DRUM BRAKE DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for the drum brake according to the manufacturer's specifications.	1. Form teams to diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action. 2. Remove, clean, inspect, and measure brake drums; determine necessary action. 3. Refinish brake drum using a brake lathe; measure final drum diameter. 4. Demonstrate how to remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. 5. Inspect and install wheel cylinders. 6. Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings. 7. Install wheel, torque lug nuts, and make final checks and adjustments. 8. Pass a drum brake diagnosis and repair assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.1, 5.2 Leadership & Teamwork: 9.3, 9.7 Demonstration & Application:

(17 hours)		11.1 **CTE Pathway:** C2.2, C2.3, C2.7, C3.3, C3.7, C8.3
J. DISC BRAKE DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for the disc brakes according to the manufacturer's specifications. (24 hours)	1. Form teams to diagnose poor stopping, noise, vibration, pulling, grabbing, dragging or pulsation concerns; determine necessary action. 2. Remove caliper assembly; inspect for leaks and damage to caliper housing; determine necessary action. 3. Clean and inspect caliper mounting and slides/pins for operation, wear, and damage; determine necessary action. 4. Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts. 5. Demonstrate how to reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks. 6. Remove, inspect, and replace pads and retaining hardware; determine necessary action. 7. Clean, inspect, and measure rotor thickness, lateral runout, and thickness variation; determine necessary action. 8. Remove and reinstall the rotor. 9. Refinish rotor on vehicle; measure final rotor thickness. 10. Refinish rotor off vehicle; measure final rotor thickness. 11. Retract caliper piston on an integrated parking brake system. 12. Check brake pad wear indicator system operation; determine necessary action. 13. Install wheel, torque lug nuts, and make final checks and adjustments. 14. Pass a disc brake diagnosis and repair assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.2, 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Demonstration & Application: 11.1 **CTE Pathway:** C2.1, C2.2, C2.3, C2.5, C2.7, C3.7, C8.3
K. POWER ASSIST UNITS DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic	1. Discuss the principles of vacuum and vacuum boosters. 2. Describe the different types of power assists units. a. vacuum booster b. hydraulic hydro booster	**Career Ready Practice:** 1, 2, 4, 5, 9, 10

and repair techniques for the brakes' power assist units according to the manufacturer's specifications. (12 hours)	c. electrical booster 3. Test pedal free travel; check power assist operation. 4. Demonstrate how to check vacuum supply to vacuum-type power booster. 5. Form teams to inspect the vacuum-type power booster unit for leaks; inspect the check valve for proper operation; determine necessary action. 6. Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine necessary action. 7. Measure and adjust master cylinder pushrod length by referring to reference books, and/or technical service bulletins. 8. Pass a power assist units diagnosis and repair assessment with an 80% score or higher.	**CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.3, C2.7, C3.3, C3.7, C4.3, C8.1, C8.3, C8.6
L. WHEEL BEARINGS, PARKING BRAKES, ELECTRICAL DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for the miscellaneous brake components according to the manufacturer's specifications.	1. Form teams to diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action. 2. Demonstrate how to remove, clean, inspect, repack, and install tapered and sealed wheel bearings and replace seals; install hub and adjust bearings. 3. Describe electric parking brake systems. 4. Check parking brake cables and components for wear, binding, and corrosion; clean, lubricate, adjust, or replace as needed. 5. Check parking brake and indicator light system operation; determine necessary action. 6. Check operation of brake stop light system; determine necessary action. 7. Pass a wheel bearings, parking brakes, electrical, diagnosis and repair assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.2, 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7

(12 hours)		Demonstration & Application: 11.1 **CTE Pathway:** C2.3, C3.7, C7.1, C7.7, C8.3
M. ELECTRONIC BRAKE, ANTI LOCK BRAKE SYSTEM, TRACTION AND STABILITY CONTROL SYSTEMS DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for the antilock brake system, traction, and stability control systems of electronic brakes according to the manufacturer's specifications.	1. Identify and inspect electronic brake control system components; determine necessary action. 2. Define and describe the antilock brake system (ABS) operation: a. integral ABS b. non-integral ABS 3. Form teams to diagnose poor stopping, wheel lock-up, abnormal pedal feel, unwanted application, and noise concerns associated with the electronic brake control system; determine necessary action. 4. Diagnose electronic brake control system electronic control(s) and components by retrieving diagnostic trouble codes, and/or using recommended test equipment; determine necessary action. 5. Depressurize high-pressure components of the ABS system: a. integral unit b. accumulator 6. Describe the procedure to bleed the electronic brake control system hydraulic circuits. 7. Demonstrate how to test, diagnose, and service electronic brake control system wheel speed sensors: a. digital and analog b. toothed ring (tone wheel) c. circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) and scan tool. 8. Diagnose electronic brake control system braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). 9. Identify traction control system (TCS) / electronic stability control (ESC) system components.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2 Problem Solving & Critical Thinking: 5.1, 5.2, 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.3, C2.7, C3.3, C3.7, C5.6, C8.3

(24 hours)	10. Describe the operation of a regenerative braking system. 11. Pass an electronic brake, anti lock brake system, traction and stability control system diagnosis and repair assessment with an 80% score or higher.	
N. EMPLOYABILITY SKILLS AND RESUME PREPARATION Understand, apply, and evaluate the employability skills and resume preparation desired of automotive technicians.	1. Understand and define employer requirements for soft skills such as: a. attitude toward work b. communication and collaboration c. critical thinking, problem solving, and decision-making d. customer service e. diversity in the workplace f. flexibility and adaptability g. interpersonal skills h. leadership and responsibility i. punctuality and attendance j. quality of work k. respect, cultural and diversity differences l. teamwork m. time management n. trust and ethical behavior o. work ethic 2. Develop a career plan that reflects career interests, pathways, and post-secondary options. 3. Create/revise a resume, cover letter and/or portfolio. 4. Demonstrate, analyze, research, and review the role of online job searching platforms and career websites to make informed decisions. 5. Understand the importance of assessing social media account content for professionalism. 6. Demonstrate and complete and/or review an on-line job application. 7. Understand and demonstrate interview skills to get the job: a. do's and don'ts for job interviews b. how to dress for the job	**Career Ready Practice:** 1, 2, 3, 4, 5, 7, 8, 9, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.4. 2.5 Career Planning & Management: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.8, 3.9 Technology: 4.1, 4.2, 4.3, 4.5 Problem Solving & Critical Thinking: 5.1, 5.4 Responsibility & Flexibility: 7.2, 7.3, 7.4, 7.7 Ethics & Legal Responsibilities: 8.3, 8.4, 8.5 Leadership & Teamwork: 9.1, 9.2, 9.3, 9.4, 9.6, 9.7 Technical Knowledge & Skills: 10.1, 10.3 Demonstration & Application:

(4 hours)	8. Demonstrate and create sample follow-up letters. 9. Understand the importance of the continuous upgrading of job skills as it relates to: a. certification, licensure, and/or renewal b. professional organizations/events c. industry associations and/or organized labor	11.1, 11.2, 11.5 **CTE Pathway:** C5.4, C5.5
O. ENTREPRENEURIAL SKILLS Understand, apply, and evaluate the process involved in becoming an entrepreneur in the automotive industry. (5 hours)	1. Define entrepreneurship. 2. Identify and research the necessary characteristics of successful entrepreneurs. 3. Examine personal goals prior to starting a business. 4. Evaluate sources of monetary investment in a business opportunity. 5. Explain licensing/permit requirements for a business. 6. Explain how the Small Business Administration (SBA) assists entrepreneurs with lenders and funding to help them plan, start and grow a business. 7. Demonstrate a budget to identify start-up expenses. 8. Pass an entrepreneurial skills assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 4, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.1, 4.2, 4.5 Responsibility & Flexibility: 7.1, 7.6 Technical Knowledge & Skills: 10.1, 10.3, 10.4 Demonstration & Application: 11.1, 11.2, 11.3, 11.4, **CTE Pathway:** C5.1, C5.2, C5.3, C5.5

ACKNOWLEDGEMENTS

Thanks to the following individuals for their contributions in developing and editing this curriculum:

Ana Martinez, Victor Lerma, Seyed Saidi, and Juan Soltero