



El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	ATEC
Course Number:	14
Descriptive Title:	Brakes
Division:	Industry and Technology
Department:	Automotive Technology
Course Disciplines:	Automotive Technology
Catalog Description:	<p>This course covers the theory and operation, diagnosis, service, and repair of automotive braking systems.</p> <p><i>Note: The two-course sequence Automotive Technology 14 and 16 is the same as Automotive Technology 11.</i></p>
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Automotive Technology 1 and Automotive Technology 22A or Automotive Technology 23 and Automotive Technology 24 and Automotive Technology 22B or Automotive Technology 25 and Automotive Technology 26 and eligibility for English 1A
Enrollment Limitation:	
Hours Lecture (per week):	2.5
Hours Laboratory (per week):	4.5
Outside Study Hours:	5
Total Course Hours:	126
Course Units:	4
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Prior to July 1992
Transfer UC:	no
Effective Date:	
General Education:	ECC
Term:	
Other:	
CSU GE:	
Term:	
Other:	

IGETC:	
Term:	
Other:	
Student Learning Outcomes:	<p>SLO #1 Safety Students must comply with shop safety practices though safety exam proficiency.</p> <p>SLO #2 General Students will complete general brake systems diagnosis.</p> <p>SLO #3 System Specific Students will have comprehension of hydraulic system, disc brake, drum brake, and power-assist unit diagnosis and repair.</p>
Course Objectives:	<ol style="list-style-type: none"> 1. Complete a safety test with 100% accuracy. 2. Select and use the proper tools and equipment safely and efficiently. 3. Inspect, test and evaluate drum, disc and Anti-Lock Braking (ABS) systems. 4. Service and adjust drum, disc, and ABS systems. 5. Diagnose and repair drum, disc, and ABS system functions. 6. Demonstrate the proper removal and installation of tires and wheels.
Major Topics:	<p>I. Shop policies safety, automotive service industry terms, precision measuring and tools (3 hours, lecture)</p> <ol style="list-style-type: none"> A. Safety information and test <ol style="list-style-type: none"> 1. Course requirements 2. Safety and Pollution Prevention (SP2) 3. Shop policies B. Automotive service industry terms <ol style="list-style-type: none"> 1. Service information resources 2. Requirements for Automotive Service Excellence (ASE) certification C. Legal rights and responsibilities under repair orders Precision measuring, tools and instruments <ol style="list-style-type: none"> 1. Micrometer 2. Rulers 3. Drum micrometer 4. Dial indicator D. Math and measuring instruments for ensuring measurements within specifications <p>II. Precision measuring, tool, safety, and repair orders (5 hours, lab)</p> <ol style="list-style-type: none"> A. Precision measuring <ol style="list-style-type: none"> 1. Metric and U.S. customary systems for length and torque B. Tools and equipment <ol style="list-style-type: none"> 1. Diagnostic tools for brakes, steering and suspension 2. Safety practices 3. Hazardous materials 4. Occupational Safety and Health Administration (OSHA)

- C. Repair Orders
 - 1. Vehicle inspections
 - 2. Service repair order
 - 3. Parts and labor calculations
 - 4. Using workshop, electronic and other service information

III. Disc brakes (8 hours, lecture)

- A. Disc brakes
- B. Basic parts
- C. Types of rotors and hub assemblies
- D. Operation of a brake caliper
- E. Different kinds and parts of a brake caliper
- F. Friction material
- G. Brake pad wear indicators
- H. Parking brakes used in rear discs
- I. Types of wheel and axle bearings

IV. Disc brakes (17.5 hours, lab)

- A. Disc brake problems and causes
- B. Brake pads
- C. Caliper
- D. Caliper overhaul
- E. Asbestos containment
- F. Brake rotors replacing, inspecting and measuring
- G. Machining to correct dimensions and finishing on a lathe
- H. Final brake system checks and adjustments
- I. Sealed wheel bearings
- J. Tapered roller wheel bearings

V. Wheel bearings/wheel bearing and seal service (2 hours, lecture)

- A. Purposes and types
- B. Types of loads
- C. Rear-wheel drive rear axle bearings
- D. Seal location
- E. Seals designs and purpose
- F. Garter spring for a seal lip
- G. Flutes on seal lips
- H. Grease classifications

VI. Wheel bearings/wheel bearing and seal service (2.5 hours, lab)

- A. Defects
- B. Cleaning
- C. Repacking
- D. Measuring end play
- E. Adjusting
- F. Seal installation
- G. Front drive axles and hub units
- H. Rear axle bearings on rear-wheel drive cars

- I. Diagnosing wheel bearings and hub units

VII. Drum brakes (8 hours, lecture)

- A. Basic parts, operation and different types
- B. Friction linings and placements on the shoe
- C. Wheel cylinder
- D. Duo-servo and leading-trailing shoe brake
- E. Self-adjusters

VIII. Drum brakes (17.5 hours, lab)

- A. Drum brake problems
- B. Brake backing plates
- C. Wheel cylinder and overhauling
- D. Lubricating
- E. Edge code identifying and selecting
- F. Identifying correct positioning of shoes
- G. Drum service
- H. Refinishing drums on a brake lathe
- I. Making final adjustments

IX. Parking brakes (3 hours, lecture)

- A. Basic types
- B. Controls
- C. Types of cables
- D. Operation of disc, drum and electric parking brakes

X. Parking brakes (2.5 hours, lab)

- A. Diagnosing problems
- B. Inspecting the system
- C. Cleaning and replacing all system parts as needed
- D. Lubricating the system
- E. Adjusting
- F. Servicing electric parking brake systems

XI. Power assist (4.5 hours, lecture)

- A. Atmospheric pressure and vacuum
- B. Power brake vacuum booster the use of atmospheric pressure and vacuum
- C. Types of vacuum boosters
- D. Parts and operation
- E. Diaphragm assembly
- F. Air and vacuum systems
- G. Single diaphragm lever-reaction vacuum booster and reaction-disc vacuum booster
- H. Tandem diaphragm
- I. Hydro-boost hydraulic power-assist system

XII. Power assist (5 hours, lab)

- A. Vacuum power booster problems
- B. Pedal free play
- C. Vacuum supply
- D. Inspecting for vacuum leaks and check valve operation
- E. Pedal linkage, vacuuming, booster and pushrod
- F. Vacuuming booster disassembling, repairing and adjusting
- G. Inspecting and testing for leaks and proper operation
- H. Hydro-boost and accumulator
- I. Hydro-boost system adjusting, replacing components, flushing, bleeding and testing

XIII. Hydraulic systems (4.5 hours, lecture)

- A. Hydraulic brake lines
- B. Flares and fittings used on brake line tubing
- C. Mounting of flexible brake line hoses
- D. Strength requirements for tubing and hoses construction
- E. Precautions for working with brake tubing and hoses
- F. Metering, proportioning, combination and pressure differential valves
- G. Brake failure warning, fluid level and stop lamp switch

XIV. Hydraulic systems (5 hours, lab)

- A. Pressure tests
- B. Resetting a pressure differential valve
- C. Inspecting for brake lines and hose
- D. Double and International Standards Organization (ISO) flares, lines, hoses and fittings
- E. Fabricating and bending brake tubing
- F. Diagnosing conditions caused by brake lines, brake hoses and system valves
- G. Metering, pressure differential and combination valves
- H. Proportioning valves and height-sensing proportioning valve
- I. Diagnosing electrical problems

XV. Anti-lock brake systems (ABS) - electrical braking systems (6 hours, lecture)

- A. Electronic terms use on electrical braking systems
- B. Typical ABS components and operation
- C. Integrated ABS versus nonintegrated ABS
- D. Major components of two-wheel, four-wheel, three-channel and four-channel ABS
- E. Traction Control System (TCS)
- F. Integration of braking, steering and suspension systems

XVI. Anti-lock brake systems (ABS) - electrical braking systems (20 hours, lab)

- A. Determine if a complaint is related to base brake or anti-lock system
- B. Relieving high pressure
- C. Bleeding an ABS
- D. Diagnostic trouble codes

	<ul style="list-style-type: none"> E. Charting voltage and resistance tests F. Tests on a speed sensor G. Oscilloscope resistance and voltage waveform H. Interpreting signal waveforms I. Removing and replacing wheel speed sensor and ABS computer (control module) <p>XVII. Anti-lock brake systems (ABS) - advanced braking systems (6 hours, lecture)</p> <ul style="list-style-type: none"> A. Stability control and sensors used B. Stability control with ABS/TCS systems C. Active braking D. Cruise control systems with active braking E. Regenerative braking system on a hybrid vehicle <p>XVIII. Anti-lock brake systems (ABS) - advanced braking systems (6 hours, lab)</p> <ul style="list-style-type: none"> A. ABS/TCS system service and diagnosis B. Service of the stability control sensors C. Diagnosis of active braking D. General diagnosis on regenerative braking system
Total Lecture Hours:	45
Total Laboratory Hours:	81
Total Hours:	126
Primary Method of Evaluation:	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Complete a 7-10 page worksheet packet that covers specific Automotive Service Excellence Education Foundation tasks for ASE A5 brakes certification exams Submit worksheet packet to the instructor.
Critical Thinking Assignment 1:	Perform a complete vehicle brake inspection. The inspection shall include a one-page report of recommended repairs and list of parts required. Submit report to the instructor.
Critical Thinking Assignment 2:	Given a problem with an ABS, research shop manual diagnostic references. Report findings on a one-page repair order indicating correct repair procedures and perform needed repairs according to manufacturer's specifications. Submit report to the instructor for evaluation.
Other Evaluation Methods:	<ul style="list-style-type: none"> Class Performance Completion Homework Problems Laboratory Reports Matching Items Multiple Choice Other (specify) Other Exams Performance Exams Quizzes Written Homework
Instructional Methods:	<ul style="list-style-type: none"> Demonstration Discussion Field trips

	<p>Group Activities</p> <p>Guest Speakers</p> <p>Laboratory</p> <p>Lecture</p> <p>Multimedia presentations</p>
If other:	<p>Internet Presentation/Resources</p> <p>Automotive Component Models</p> <p>Collaborative Learning</p> <p>E Based Learning</p>
Work Outside of Class:	<p>Answer questions</p> <p>Observation of or participation in an activity related to course content (such as theatre event, museum, concert, debate, meeting)</p> <p>Other (specify)</p> <p>Problem solving activity</p> <p>Required reading</p> <p>Study</p> <p>Written work (such as essay/composition/report/analysis/research)</p>
If Other:	<p>Web-based training</p>
Up-To-Date Representative Textbooks:	<p>Ken Pickerill, <u>Today's Technician: Automotive Brake Systems (Bundle)</u>, 2019, Cengage Learning</p>
Alternative Textbooks:	
Required Supplementary Readings:	<p>Lab sheets, procedure sheets and automotive shop manuals</p>
Other Required Materials:	<p>Shop safe clothing</p> <p>Three-ring binder</p> <p>Notebook and paper</p> <p>Pen and pencil</p> <p>Safety glasses</p> <p>Shop safe clothing</p> <p>Closed-toe shoes</p> <p>Tools (optional)</p>
Requisite:	
Category:	
Requisite course(s): List both prerequisites and corequisites in this box.	
Requisite and Matching skill(s): Bold the requisite skill. List the corresponding	

course objective under each skill(s).	
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	Automotive Technology 1 and Automotive Technology 22A or Automotive Technology 23 and Automotive Technology 24 and Automotive Technology 22B or Automotive Technology 25 and Automotive Technology 26
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	Ability to perform electrical diagnosis. ATEC 24 - Perform engine diagnosis using a flow chart. ATEC 23 - Determine engine condition by performing compression, cylinder leakage, and vacuum tests. ATEC 24 - Test and diagnosis of an engine using engine testing equipment. ATEC 26 - Perform engine diagnosis using a flow chart. ATEC 26 - Test and diagnose an engine using OBD 2 scan tools/engine analyzers. ATEC 25 - Diagnose and repair electrical circuits. ATEC 25 - Examine electrical components. ATEC 23 - Evaluate and test engine condition and performance using engine analyzer/scanner. ATEC 25 - Diagnose electrical circuits (Automotive Service Excellence (ASE) tests). ATEC 26 - Test, diagnose and repair computer controlled systems. ATEC 24 - Evaluate and repair fuel injection systems. ATEC 22A - Test, evaluate, and repair electrical circuits. ATEC 25 - Diagnose and repair computer controlled systems. ATEC 26 - Analyze electrical testing data and recommend repairs.

	<p>ATEC 25 - Evaluate computer controlled components.</p> <p>ATEC 24 - Analyze computer controlled engine data and form a conclusion of recommended needed repairs.</p> <p>ATEC 23 - Interpret engine analyzer/scanner data and recommended repairs needed.</p> <p>Select and use the proper tools.</p> <p>ATEC 1 - Select and use the proper tools.</p> <p>Inspect, evaluate and service braking system components.</p> <p>ATEC 1 - Inspect, service, test and evaluate a braking system.</p> <p>Perform diagnostic tasks using a flow chart.</p> <p>ATEC 22B - Perform engine diagnosis using a flow chart.</p> <p>Test, evaluate, and repair electrical circuits.</p> <p>ATEC 22A - Test, evaluate, and repair electrical circuits.</p> <p>Evaluate, diagnose and repair electrical systems</p> <p>ATEC 22B - Evaluate, diagnose and repair electrical systems.</p>
Requisite Skill:	Eligibility for English 1A
Requisite Skill and Matching skill(s): Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable	<p>Ability to read automotive related material.</p> <p>Summarize, analyze, evaluate, and synthesize college-level texts.</p>
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	John Lewis
Date:	09/01/1986
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Edward Matykiewicz
Date:	03/05/2022
Last Board Approval Date:	1/17/2023

