



El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	ATEC
Course Number:	33
Descriptive Title:	Transmissions, Drive Train and Drive Axles
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 automatic and manual transmissions, transaxles, and drive trains.</p> <p><i>Note: This course is the same as the two-course sequence Automotive Technology 34 and 35. Students who have completed Automotive Technology 34 and 35 will not receive credit for Automotive Technology 33.</i></p>
Prerequisite:	
Co-requisite:	
Recommended Preparation:	Automotive Technology 1 or Automotive Technology 21 and Eligibility for English 1A
Enrollment Limitation:	
Hours Lecture (per week):	5
Hours Laboratory (per week):	10
Outside Study Hours:	10
Total Course Hours:	270
Course Units:	8
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Prior to July 1992
Transfer UC:	Yes
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	

Other:	
IGETC:	
Term:	
Other:	
<p>Student Learning Outcomes:</p>	<p>SLO #1 Safety</p> <p>Students must comply with shop safety practices though safety exam proficiency.</p> <p>SLO #2 General</p> <p>Students will examine general automatic/manual transmission/transaxle clutch and drive axle diagnosis and repair.</p> <p>SLO #3 In/Off Vehicle</p> <p>Students will illustrate in/off vehicle automatic transmission/transaxle maintenance and repair.</p> <p>SLO #4 Shaft</p> <p>Students will illustrate drive shaft and half shaft, universal and constant-velocity (CV) joint diagnosis and repair.</p> <p>SLO#5 Four-Wheel Drive</p> <p>Students will determine four-wheel drive or all-wheel drive component diagnosis and repair.</p>
<p>Course Objectives:</p>	<ol style="list-style-type: none"> 1. A student must be proficient in automotive lab safety policies set by the automotive department. Proficiency set by the department will meet current industry standards. 2. Select and use the proper tools and equipment safely and efficiently. 3. The Student must understand the commonly used diagnostics procedures to find faults in automatic or manual transmissions and transaxles. 4. The student understands the common maintenance and repair procedures used for in-vehicle automatic transmissions and transaxles. 5. The student understands out of vehicle repair procedures used on automatic transmissions and transaxles. 6. The student must understand drive shaft and half shaft, universal and constant-velocity (CV) joint diagnosis and repair. 7. The student must understand Drive Axle Diagnosis and Repair. 8. The student must understand four-wheel drive or all-wheel drive component diagnosis and repair.
<p>Major Topics:</p>	<p>I. Shop Policies Safety, Automotive Service Industry Terms, Precision Measuring and Tools (5 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
 - 1. Service information resources
 - 2. Requirements for Automotive Service Excellence (ASE) certification
 - 3. Legal rights and responsibilities under repair orders
- C. Precision measuring, tools and instruments
 - 1. Precision measuring, tools and instruments
 - 2. Math and measuring correcting clearances

II. Precision Measuring, Tool, Safety and Repair Orders (10 hours, lab)

- A. Precision measuring
 - 1. Metric and U.S. customary systems for distance and torque
- B. Tools and equipment
 - 1. Diagnostic tools for Heating and Air Conditioning
 - 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 or other service information

III. Clutches (5 hours, lecture)

- A. Purpose
- B. Major components and roles of each
- C. Operation of a wet, dry and dual clutch
- D. Clutch linkages mechanical, cable-type and hydraulic

IV. Clutches (10 hours, lab)

- A. Diagnose clutch-related problems
- B. Inspect, adjust and replace of system parts
- C. Bleed a hydraulic clutch system
- D. Transmission case mating surfaces
- E. Powertrain mounts

V. Manual Transmissions/Transaxles (10 hours, lecture)

- A. Purpose design and operation of
- B. Flow of power
- C. Synchronizer assembly

- D. Lubrication in a manual transmission/transaxle

VI. Manual Transmissions/Transaxles (20 hours, lab)

- A. Noise
- B. Hard shifting and jumping out of gear
- C. Fluid leakage
- D. Gaskets and sealing surfaces
- E. Shift linkages
- F. Disassemble and assemble transmission or transaxle components
- G. Vents
- H. Lubrication devices
- I. End play and preload
- J. Shim selection procedure

VII. Front Drive Axles (2.5 hours, lecture)

- A. Purpose
- B. Operation
- C. Constant-Velocity (CV) joints
- D. Ball-type or Tripod-type CV joint
- E. Methods used to offset torque steer

VIII. Front Drive Axles (5 hours, lab)

- A. Road test to identify problems
- B. Diagnose and determine noise or vibration
- C. Shafts
- D. Boots
- E. CV joints
- F. Four Wheel Drive (FWD) front wheel bearings
- G. Hubs

IX. Drive Shafts and Universal Joints (2.5 hours, lecture)

- A. Purpose and construction
- B. Drive shaft designs
- C. Universal joint
- D. Drive shaft balance
- E. Natural speed variations
- F. Canceling angles

X. Drive Shafts and Universal Joints (5 hours, lab)

- A. Noise and Vibration
- B. Yokes
- C. Boots
- D. Universal joints
- E. Center support bearings
- F. Shaft balance and runout measurement
- G. Measuring and adjusting shaft angles

XI. Differentials and Drive Axles (10 hours, lecture)

- A. Purpose
- B. Construction and operation
- C. Major components
- D. Gears Types
- E. Drive pinion bearing preload
- F. Major bearings
- G. Limited-slip differential
- H. Axle housings
- I. FWD
- J. Bearings used to support

XII. Differentials and Drive Axles (20 hours, lab)

- A. Diagnostic
- B. Limited-slip differential problems and cone or plate pack
- C. Companion flange and pinion seal
- D. Ring and pinion gear set removal measure and adjust
- E. Collapsible spacers
- F. Differential case and runout
- G. Tooth contact pattern
- H. Pinion depth and bearing and differential (side) bearing preload
- I. Backlash (threaded cup or shim type)
- J. Shaft end play/preload (shim/spacer selection procedure)
- K. Lubricant
- L. Wheel studs
- M. Shaft bearings, retainers and seals
- N. Rear axle flange run out and end play

XIII. Four-Wheel Drive Systems (10 hours, lecture)

- A. Advantages and disadvantages
- B. Terminology
- C. Different designs and applications
- D. Components
- E. Operation of various transfer case
- F. Manual or Automatic locking front wheel hubs
- G. Suspension requirements

XIV. Four-Wheel Drive Systems (20 hours, lab)

- A. Noise and vibration
- B. Hard shifting
- C. Steering problems
- D. Shifting mechanisms
- E. Check lube level
- F. Front drive shafts
- G. Axle knuckles
- H. Locking hubs
- I. Drive unit seals

XV. Advanced Four-Wheel Drive Systems (2.5 hours, lecture)

- A. Terminology
- B. Different designs and applications
- C. Components
- D. Viscous coupling
- E. All Wheel Drive (AWD) systems operation of common types

XVI. Advanced Four-Wheel Drive Systems (5 hours, lab)

- A. Procedures for diagnosing shift problems
- B. Center differential assemblies
- C. Viscous coupling units
- D. Vacuum operated "shift-on-the-fly" systems
- E. On-demand Four-Wheel Drive Systems
- F. AWD systems
- G. Differential lock systems

XVII. Electronically Controlled and Automated Transmissions (2.5 hours, lecture)

- A. Continuously Variable Transmission (CVT)
- B. Hybrid vehicles transmissions
- C. Sequential manual transmission
- D. Dual clutch transmission

XVIII. Electronically Controlled and Automated Transmissions (5 hours, lab)

- A. Vehicle's onboard diagnostic system
- B. Diagnosing drive train systems with intermittent problems
- C. Control modules reprogram and update
- D. Primary sensors and electrical circuit testing
- E. Computer voltage supply
- F. Outputs and actuators
- G. Electric motor-related problems diagnostics
- H. Electromagnetic devices diagnostics

XIX. Automatic Transmission Operation, Diagnosis, Maintenance and Basic Adjustments (5 hours, lecture)

- A. Factors that determine shift
- B. Four basic systems
- C. Torque converter
- D. Hydraulic machines operation
- E. Transmission's hydraulic circuit
- F. Valve body, fluid flow and pressurization
- G. Reaction members

XX. Automatic Transmission Operation, Diagnosis, Maintenance and Basic Adjustments (10 hours, lab)

- A. Problem analysis
- B. Driver's complaint

- C. Road test the vehicle
- D. Researching service information
- E. Preliminary checks, visual inspection and diagnosis
- F. Determining the needed repairs and verifying repair
- G. Fluid inspection, replacing fluid and filters
- H. Noise and vibration problems
- I. Oil pressure tests
- J. In vehicle repairs manual valve shift linkage, extension housing and parking pawl

XXI. Electronic Controls/Electrical and Electronic System Diagnosis and Service (5 hours, lecture)

- A. Electrical terms
- B. Ohm's Law
- C. Electronically controlled transmission systems
- D. Input and output devices
- E. Basic types of sensors
- F. Elementary shift logic chart
- G. Shift characteristics of each selector lever position
- H. Adaptive learning

XXII. Electronic Controls/Electrical and Electronic System Diagnosis and Service (10 hours, lab)

- A. Road test
- B. Electrical or mechanical faults
- C. Preliminary checks and trouble codes
- D. Converter clutch system
- E. Switches, sensors and solenoids
- F. Transmission-related electrical/electronic components
- G. Diagnostic procedures for Diagnostic Trouble Code (DTC) and/or symptom

XXIII. Automatic Transmission Designs/Rebuilding Transmissions and Transaxles (10 hours, lecture)

- A. Transaxle
- B. Transmission
- C. Driveline
- D. Common transmission model number systems
- E. Major internal parts of an automatic transmission/transaxle
- F. Compound planetary gearsets
- G. Seals and gaskets
- H. Mounts

XXIV. Automatic Transmission Designs/Rebuilding Transmissions and Transaxles (20 hours, lab)

- A. Diagnosing
- B. Removing and installing
- C. Disassembling and reassembling
- D. Cleaning
- E. Transmission case bores, passages and bushings

- F. Vents
- G. Mating surfaces of a transmission case
- H. Extension housing bushings and seals
- I. External seals and gaskets

XXV. Torque Converters and Pumps (5 hours, lecture)

- A. Major components
- B. Fluid flows
- C. Torque converter efficiency enhancement
- D. Stator
- E. Torque converter fluid flow
- F. Stall and coupling phase
- G. Torque converters with a clutch
- H. Typical electronic controls for a converter clutch
- I. Pumps in transmissions

XXVI. Torque Converters and Pumps (10 hours, lab)

- A. Stall test
- B. Converter clutch system tests
- C. Hydraulically or electrically controlled
- D. Flexplate, attaching bolts and pilot
- E. Pump drive surfaces
- F. Measuring torque converter end play
- G. Check stator clutch
- H. Cooling system
- I. Cooler, lines and fittings
- J. Oil pump assembly and related components

XXVII. Hydraulic Circuits and Controls/General Hydraulic System Service (5 hours, lecture)

- A. Hydraulic controls used in modern transmissions
- B. Pressures
- C. Basic types of valves used in automatic transmissions
- D. Pressure Control Solenoid (PCS) assembly
- E. Load-sensing devices for automatic transmission efficiency
- F. Transmission valve body

XXVIII. Hydraulic Circuits and Controls/General Hydraulic System Service (10 hours, lab)

- A. Valve body remove and install
- B. Valve body bores
- C. Mating surfaces
- D. Spacers and gaskets
- E. Bolt torque

XXIX. Gears and Shafts/Gear and Shaft Service (5 hours, lecture)

- A. Basic planetary gearset

	<ul style="list-style-type: none"> B. Gear ratios C. Simpson-gear-based transmissions D. Ravigneaux-gear-based transmissions E. Lepelletier-gear-based transmissions F. Planetary gearsets in tandem <p>XXX. Gears and Shafts/Gear and Shaft Service (10 hours, lab)</p> <ul style="list-style-type: none"> A. Thrust washers, bearings and bushings B. Shafts and shaft seals C. Drive chains, sprockets and gears D. Parking pawls E. Final drive components <p>XXXI. Reaction and Friction Units/Friction and Reaction Unit Service (5 hours, lecture)</p> <ul style="list-style-type: none"> A. Reaction members B. Hydraulic servo and brake band C. One-way clutches D. Multiple-disc clutch <p>XXXII. Reaction and Friction Units/Friction and Reaction Unit Service (10 hours, lab)</p> <ul style="list-style-type: none"> A. Bands B. Friction and pressure plates C. Servo and accumulator D. Roller and sprag clutch E. Clutch pack clearance and air test operation
Total Lecture Hours:	90
Total Laboratory Hours:	180
Total Hours:	270
Primary Method of Evaluation:	3) Skills demonstration
Typical Assignment Using Primary Method of Evaluation:	Complete a 3-5 page worksheet packet that covers specific National Automotive Technicians Education Foundation (NATEF) tasks for Automotive Service Excellence (ASE) A5 transmissions. Submit worksheet packet to the instructor.
Critical Thinking Assignment 1:	Analyze a vehicle's transmission/transaxle problem and research shop manual diagnostic references needed to write a one-page repair order indicating correct repair procedures. Perform needed repairs according to manufacturer's specifications. Submit repair order to the instructor.
Critical Thinking Assignment 2:	Analyze and measure transmission/transaxle components to determine the actual cause of failure and evaluate the quality of the transmission/transaxle repair. Summarize findings in a 2-3 page report and submit report to the instructor.
Other Evaluation Methods:	Performance exams Objective Exams Quizzes Laboratory reports

	<p>Class Performance Homework Problems Term or other papers Multiple Choice Completion Matching Items True/False Journal (kept regularly throughout the course)</p>
Instructional Methods:	<p>Demonstration Discussion Group Activities Guest Speakers Laboratory Lecture Multimedia presentations Simulation</p>
If other:	<p>Collaborative Learning E-Based Learning</p>
Work Outside of Class:	<p>Study Answer questions Required reading Problem solving activities Written work Observation of activity related to course content or participation in an activity related to course content</p>
If Other:	<p>Web-based training</p>
Up-To-Date Representative Textbooks:	<p>Jack Erjavec, <u>Today's Technician: Manual and Transaxles</u>, 7th edition, Delmar Cengage Learning, 2019. Jack Erjavec, <u>Today's Technician: Automatic Transmissions and Transaxles Transmissions</u>, 7th edition, Delmar Cengage Learning, 2019.</p>
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	<p>Safety Glasses Writing Materials 1 inch three-ring binder Proper work attire: Uniform type work shirt Work type pants Enclosed shoe</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 or Automotive Technology 21
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	<p>The automotive department's shop policies and safety procedures.</p> <p>ATEC 1 - Complete a safety test with 100% accuracy.</p> <p>Basic hand tools and their uses.</p> <p>ATEC 1 - Select and use the proper tools.</p> <p>A basic understanding of engine performance.</p> <p>ATEC 21 - Distinguish engine components.</p> <p>ATEC 21 - Perform an analysis of an engine condition by conducting compression, cylinder leakage, and vacuum tests.</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 materials.</p> <p>ENGL 1 - Summarize, analyze, evaluate, and synthesize college-level texts.</p> <p>Ability to write an automotive report.</p> <p>ENGL 1 - Write a well-reasoned, well-supported expository essay that demonstrates application of the academic writing process.</p>
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	John Lewis
Date:	09/01/1985
Original Board Approval Date:	

Last Reviewed and/or Revised by:	Edward Matykiewicz
Date:	03/03/2022
Last Board Approval Date:	06/20/2022