



El Camino College
COURSE OUTLINE OF RECORD – Official

Course Acronym:	ATEC
Course Number:	35
Descriptive Title:	Manual Transmission, 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 manual transmissions, drive axles, and drive trains.</p> <p><i>Note: The two-course sequence Automotive Technology 34 and 35 is the same as Automotive Technology 33. 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 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:	Yes
Effective Date:	
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	
Other:	

	IGETC:
	Term:
	Other:
Student Learning Outcomes:	<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 drive train diagnosis.</p> <p>SLO #3 Diagnosis and Repair</p> <p>Students will have a comprehension of clutch, manual transmission/transaxle and drive axle diagnosis and repair.</p> <p>SLO #4 Drive Shaft</p> <p>Students will illustrate drive shaft and half shaft, universal and constant-velocity (CV) joint diagnosis and repair.</p>
Course Objectives:	<ol style="list-style-type: none"> 1. Score 100% accuracy on a safety test. 2. Select and use the proper tools and equipment safely and efficiently. 3. Inspect, test, and evaluate manual transmissions and clutch operation. 4. Service and adjust manual transmissions and clutches. 5. Diagnose and repair manual transmission and clutch malfunctions. 6. Inspect, test, and evaluate drive axle operation. 7. Evaluate and adjust drive axles. 8. Diagnose and repair drive axle malfunctions. 9. Inspect, test, and evaluate drive and axle shafts and flexible joints. 10. Service and adjust drive and axle shafts and flexible joints. 11. Evaluate and repair drive and axle shafts.
Major Topics:	<p>I. Precision Measuring, Tool, Safety and Repair Orders (2.5 hours, lecture)</p> <p>A. Precision measuring</p> <ol style="list-style-type: none"> 1. Metric systems for distance and torque 2. U.S. customary systems for distance and torque <p>B. Tools and equipment</p> <ol style="list-style-type: none"> 1. Diagnostic tools for Heating and Air Conditioning 2. Safety practices 3. Hazardous materials 4. Occupational Safety and Health Administration (OSHA) <p>C. Repair Orders</p> <ol style="list-style-type: none"> 1. Vehicle inspections 2. Service repair order 3. Parts and labor calculations 4. Using workshop, electronic or other service information

II. Shop Policies Safety, Automotive Service Industry Terms, Precision Measuring and Tools (7.0 hours, lab)

- A. Safety information and test
 - 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

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 (8 hours, lab)

- A. Diagnosing clutch-related problems
- B. Inspecting, adjusting and replacing of system parts
- C. Bleeding a hydraulic clutch system
- D. Transmission case mating surfaces
- E. Powertrain mounts

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

- A. Purpose design and operation
- B. Flow of power
- C. Synchronizer assembly
- D. Lubrication in a manual transmission/transaxle

VI. Manual Transmissions/Transaxles (19 hours, lab)

- A. Noise
- B. Hard shifting and jumping out of gear
- C. Fluid leakage
- D. Gaskets and sealing surfaces
- E. Shift linkages
- F. Disassembling and assembling 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 (4 hours, lab)

- A. Road test to identify problems
- B. Diagnosing and determining noise or vibration
- C. Shafts
- D. Boots
- E. CV joints
- F. Front 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 (4 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 (19 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 bearing preload
- I. Backlash
- J. Shaft end play/preload
- 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 (5 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 (8 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 (4 hours, lab)

- A. Procedures for diagnosing shift problems
- B. Center differential assemblies
- C. Viscous coupling units

	<ul style="list-style-type: none"> D. Vacuum operated "shift-on-the-fly" systems E. On-demand Four Wheel Drive (4X4) systems F. AWD systems G. Differential lock systems <p>XVII. Electronically Controlled and Automated Transmissions (5 hours, lecture)</p> <ul style="list-style-type: none"> A. Continuously Variable Transmission (CVT) B. Hybrid vehicles transmissions C. Sequential manual transmission D. Dual clutch transmission <p>XVIII. Electronically Controlled and Automated Transmissions (8 hours, lab)</p> <ul style="list-style-type: none"> 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
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:	Disassemble an automotive manual transmission/transaxle. Inspect, measure components and record data on a manual transmission inspection lab sheet. Analyze data using manufacturer's specifications to determine recommended service and/or repair and parts required. Submit a five- to six-page manual transmission inspection lab sheet and supporting data 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 and perform needed repairs according to manufacturer's specifications. Submit repair order to the instructor.
Critical Thinking Assignment 2:	Complete a seven- to ten-page worksheet packet that covers specific Automotive Service Excellence Education Foundation tasks for ASE-A2 manual transmissions and drivelines certification exam. Submit worksheet packet to the instructor.
Other Evaluation Methods:	<ul style="list-style-type: none"> Performance Exams Other Exams Quizzes Laboratory Reports Class Performance Homework Problems Multiple Choice Completion Matching Items True/False

Instructional Methods:	Discussion Group Activities Internet Presentation/Resources Laboratory Lecture Multimedia Presentations Field Trips Role Play/Simulation
If other:	Internet Presentation/Resources Automotive Component Models Collaborative Learning E Based Learning
Work Outside of Class:	Answer questions Observation of or participation in an activity related to course content (such as theatre event, museum, concert, debate, meeting) Problem solving activity Required reading Skill practice Study Written work (such as essay/composition/report/analysis/research)
If Other:	Web-based training
Up-To-Date Representative Textbooks:	ack Erjavec, <u>Today's Technician: Manual Transmissions & Transaxles Classroom and Shop Manual (Bundle) 7th edition, 2020, Cengage Learning</u>
Alternative Textbooks:	
Required Supplementary Readings:	Lab sheets, procedure sheets and automotive shop manuals
Other Required Materials:	Shop safe clothing Three-ring binder Notebook and paper Pen and pencil Safety glasses Shop safe clothing Closed-toe shoes Tools (optional) Other: Web based learning
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:	<p>Automotive Technology 1 and</p> <p>Automotive Technology 22A or</p> <p>Automotive Technology 23 and</p> <p>Automotive Technology 24 and</p> <p>Automotive Technology 22B or</p> <p>Automotive Technology 25 and</p> <p>Automotive Technology 26</p>
<p>Requisite and Matching skill(s):Bold the requisite skill.</p> <p>List the corresponding course objective under each skill(s).</p>	<p>Ability to perform electrical diagnosis.</p> <p>ATEC 24 - Perform engine diagnosis using a flow chart.</p> <p>ATEC 23 - Determine engine condition by performing compression, cylinder leakage, and vacuum tests.</p> <p>ATEC 24 - Test and diagnosis of an engine using engine testing equipment.</p> <p>ATEC 26 - Perform engine diagnosis using a flow chart.</p> <p>ATEC 26 - Test and diagnose an engine using OBD 2 scan tools/engine analyzers.</p> <p>ATEC 25 - Diagnose and repair electrical circuits.</p> <p>ATEC 25 - Examine electrical components.</p> <p>ATEC 23 - Evaluate and test engine condition and performance using engine analyzer/scanner.</p> <p>ATEC 25 - Diagnose electrical circuits (Automotive Service Excellence (ASE) tests).</p> <p>ATEC 26 - Test, diagnose and repair computer controlled systems.</p> <p>ATEC 24 - Evaluate and repair fuel injection systems.</p> <p>ATEC 22A - Test, evaluate, and repair electrical circuits.</p> <p>ATEC 25 - Diagnose and repair computer controlled systems.</p> <p>ATEC 26 - Analyze electrical testing data and recommend repairs.</p>

	<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 and maintain drive line components and fluid levels.</p> <p>ATEC 1 - Inspect and maintain drive line components and fluid levels.</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> <p>Ability to write an automotive report.</p> <p>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:	10/25/1985
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Edward Matykiewicz
Date:	05/03/2022
Last Board Approval Date:	1/17/2023