AUME-761: MANUAL TRANSMISSIONS & TRANSAXLES

Effective Term
Fall 2026

BOT Approval Date
11/13/2025

Discipline
AUME - Automotive/Transportation Tech
Course Number
761

Course Title
Manual Transmissions & Transaxles

Short Title
Manual Trans./Transaxles

Credit Status (CB 04)
D - Credit - Degree applicable

Units

Lecture Units
3.00

Lab Units
1.00

Total Units
4.00

Hours

Lecture Contact Hours
48-54
Out of Class Hours Lecture
96-108

Lab Contact Hours
48-54
Out of Class Hours Lab
0.00

Total Contact Hours
96 - 108

Total Out of Class Hours
96 - 108

Total Student Learning Hours
192 - 216

Is this an existing Extensive Lab?
No

Do you want to propose this for Extensive Lab?

Yes

Distance Education

No

Catalog Description

This course covers the design, theory of operation, diagnosis and repair of manual transmissions and transaxles, clutches, drivelines, final drive units and four-wheel or all-wheel drive assemblies. The student will obtain the skills needed to properly diagnose and repair manual transmission and drive train faults. The course is designed to help the student to prepare to take the ASE A3 Manual Transmission/Transaxle certification exam.

Requisites

Recommended Preparation

Recommended Preparation (note that students can enroll in the class even if they haven't take the recommended course)
AUME-700

Codes

TOP Code (CB 03)

0948.00* - *Automotive Technology

CIP Code

47.0604 - Automobile/Automotive Mechanics Technology/Technician.

Repeatability Code

No

Grading Option

Letter grade OR P/NP

Minimum Qualifications

Minimum Qualifications	And/Or
Automotive Technology	End

Learning Objectives

Learning Objectives

Learning Objective
1. Determine the optimal electronic data base available to obtain service information necessary to perform diagnostics and repairs on the vehicle drivetrain.
2. Compose a written repair order according to California State Bureau of Automotive Repair (BAR) standards.
3. Exhibit the utilization of industry-standard safety measures to be employed while performing the diagnosis and repair of manual transmissions and transaxles.
4. Estimate the remaining service life of Propeller and Half-Shafts, Universal and Constant-Velocity joints.
5. Assess the condition of a manual transmission or transaxle and select the best method of repair or replacement according to commonly accepted industry standards.
6. Exhibit the ability to remove, disassemble, inspect, reassemble and install a manual transmission or transaxle according to commonly accepted industry standards.
7. Evaluate the condition of the clutch assembly and decide whether adjustment or replacement is necessary.
8. Determine the most efficient diagnostic and service procedures to be employed for the diagnosis and repair of a fault on an all-wheel-drive or four-wheel drive vehicle.
9. Test electronic drivetrain controls and assess typical service defects using a diagnostic scan tool.

10. Evaluate the ways that the invention of the synchromesh cone and constant-mesh, helically-cut gears had in making affordable and practical transportation accessible to all, especially the asset limited, income constrained, employed (ALICE) population.

Learning Outcome Information

Course Learning Outcomes

Learning Outcome
1. Students will evaluate the condition of various types of manual transmissions and transaxles.
2. Students will rebuild a manual transmission or transaxle unit.
3. Students will evaluate clutch operation in a manual transmission or transaxle assembly.
4. Students will evaluate the impact of the synchromesh transmission on transportation accessibility, including its effect on asset-limited, income-constrained, employed (ALICE) populations.

Content

Course Lecture Content

1. Navigating Online Service Information
    a. Popular Sources
        i. ALLDATA
        ii. Mitchell ProDemand
        iii. Introduction to Manufacturer Resources
2. Work Order Preparation
    a. State of California Bureau of Automotive Repair Standards
    b. The Three "Cs"
        i. The Customer Complaint
        ii. The Cause of the Complaint
        iii. The Correction
3. General Service Procedures
    a. Collecting Vehicle Data
        i. Decoding the VIN Number
        ii. The Vehicle Emission Control Information (VECI) Label
        iii. General Motors RPO Code Information
    b. Transmission and Transaxle Julian Dates
        i. Locating Barcode Information
        ii. Identifying the Unit if Barcode Information is Missing
    c. Interpretation of Diagnostic Scan Tool Data
        i. Diagnostic Trouble Code (DTC) Classification
        ii. Interpretation of Live Data
    d. Identification of Transmission Fluid Types
        i. Transmission/Transaxle Oil Types and Color Identification
        ii. Gear Oil Types and Identification
4. Manual Transmission/Transaxle Unit Service and Repair
    a. Shifter Linkage Inspection and Service Procedures
    b. Noise, Vibration and Harshness (NVH) Diagnostic Tools and Procedures
    c. Gear Shaft Service and Repair
        i. Types of Gears
            1. Spur (Straight-Cut) Gears
            2. Helically Cut, Constant Mesh Gears
            3. Synchronizer Description and Operation
                a. Effects of the Synchromesh Unit
                    i. Effects on Ease of Use
                    ii. Effects on the Longevity of the Unit
                    iii. Effects on Reducing Overall Long-Term Expenses
                        1. How This Made Practical Transportation More Accessible to the asset limited, income constrained, employed (ALICE) population.
5. Clutch System Service

a. Identification and Location of Clutch Components and Configurations
   i. Manual Linkage Types
      1. Linkage Adjustment Procedures
      2. Inspection Items Checklist
   ii. Hydraulically Operated Types
      1. Pascal's Law of Hydraulics
      2. Clutch Bleeding Procedures

6. Propeller Shafts and Half-Shafts
   a. Review of Drive Types and Identification Procedures
      i. Front Wheel Drive
      ii. Rear Wheel Drive
      iii. All Wheel Drive
      iv. Four Wheel Drive
   b. Types of Flexible Joints
      i. Universal Joints (Cross and Trunion)
      ii. Constant Velocity Joints (Rzeppa Joints)
7. Final Drives and Drive Axle Types
   a. Final Drive Fluids and Fluid Identification
      i. Fluid Color Codes
      ii. Case Ventilation
   b. Standard or Open Differentials
   c. Limited Slip Types
      i. Clutch Pack Based
      ii. Torsen Limited Slip Differentials
      iii. Torque Vectoring Differentials
   d. Drive Axle Types
      i. Solid or Beam Axles
      ii. Half-Shaft Type Axles
         1. Universal Joint Types
         2. Constant-Velocity Types
            a. Rzeppa Joints
            b. Tulip or Tripot Joints
   e. Transfer Case or Center Differential Types
      i. Standard Transfer Cases
      ii. Center Differentials or Viscous Clutches
         1. Manually Controlled Types
         2. Electronically Controlled Types
      iii. Torque Vectoring
         1. Sensors (Inputs), Solenoids (Outputs) and Control Modules
            a. Theory and Operation
            b. Component Identification
            c. Service and Diagnostic Procedures

Course Lab Content

1. Safety and Pollution Prevention
   a. Online Safety Certification
   b. Online Pollution Prevention Certification
2. Work Order Preparation
   a. Perform a Mock Customer Interview
   b. Prepare the Repair Cost Estimate
      i. Evaluate the Effect of the Cost of Synchromesh Failure
      ii. Effect of Synchromesh Failure on Other Transmission Components
      iii. Assess How These Types of Failures Affect Customer Long-Term Affordability and Accessibility, Especially for the Asset Limited, Income Constrained, Employed (ALICE) Population.
   c. Diagnose the Root Cause of the Customer Complaint
   d. Verify the Correction of the Primary Customer Complaint
   e. Prepare the Final Invoice

3. General Service Procedures
    a. Determine Vehicle Repair Information
    b. Identifying the Fluid Type and Capacity
    c. Retrieve Electronic Diagnostic Trouble Codes
4. Clutch Evaluation and Service Procedures
    a. Perform a Stall Test
    b. Perform Clutch System Adjustments
    c. Hydraulic System Service
    d. Clutch Replacement
        i. Component Inspection
            1. Inspect the Flywheel
                a. Dial Indicator Inspection
                b. Visual Inspection for Hard or Chill Spots
            2. Assess the Condition of the Clutch Disc
            3. Evaluate the Condition of the Pressure Plate
    e. Component Replacement
        i. Replace the Pilot Bushing
        ii. Utilize a Clutch Alignment Tool to Install the Clutch Disc
    f. Hydraulic System Bleeding
5. Transmission and Transaxle Service Procedures
    a. Removal and Replacement
    b. Unit Overhaul Procedures
        i. Precision Measurement of Components
        ii. Fluid Leak Inspection
        iii. Hydraulic Press Use
        iv. Bearing Inspection
    c. Synchronizer and Hypoid Gear Inspection
        i. Analyze Condition to Assure Quiet Operation and Unit Durability
6. Propeller and Half-Shaft Service Procedures
    a. Inspection Procedures
        i. Assess the Condition of CV Joints and Grease Boots
        ii. Evaluate the Serviceability of Universal Joints
        iii. Hub/Bearing Inspection
    b. Component Replacement and Adjustment
        i. Replace CV Axles and Half-Shafts
        ii. Repair Serviceable Propeller Shafts
        iii. Perform Hub/Bearing Assembly Replacement
7. Final Drive Service Procedures
    a. Inspect for Fluid Leaks and Assess Fluid Condition
        i. Inspect the Case Fluid Pressure Vent
    b. Limited Slip and Torque-Vector Clutch Inspection
    c. Retrieve Stored Diagnostic Trouble Codes (DTCs) from Control Modules
    d. Remove and Replace Final Drive Assemblies
    e. Rebuild Final Drive Units
8. Four-Wheel and All-Wheel Drive Unit Service Procedures
    a. Fluid Leak and Condition Inspections
    b. Identify Concerns Arising From Tire Sizes and Gear Ratio Modifications
        i. Four Wheel Drive Transfer Case Assessment
        ii. All-Wheel Drive Viscous Clutch Assembly Assessment
    c. Unit Overhaul
        i. Overhauling the Transfer Case
        ii. Overhaul and/or Replace the Viscous Clutch Assembly

Methods of Instruction

Method

Lab Activities

Integration

Students will perform different functions related to the diagnosis, removal, repair and replacement of the transmission or transaxle assembly.

Method

Lecture

Integration

The instructor will deliver lecture presentations on subjects related to manual transmission and drivetrain design and operation, such as clutch function and transmission power flow.

Method

Observation and Demonstration

Integration

The instructor will demonstrate the performance of various service, diagnosis and repair procedures related to manual transmissions in the lab setting.

Method

Papers and Reports

Integration

Students will be asked to research the effects of improvement and innovation in automotive technology; in particular, the effect that the introduction of Constant-Mesh Gears and Synchromesh Units had on making practical transportation more accessible and affordable, especially for the asset limited, income constrained, employed (ALICE) population.

Method

Reading

Integration

The instructor will give reading assignments from the required textbook concerning component identification, the theory of operation, diagnosis and repair of modern manual transmissions and drivetrains, including different types of propeller shafts, universal (Cardan) and Constant-Velocity (Rzeppa) joints, open, limited slip and center differentials and transfer cases

Method

Role Playing/Simulation

Integration

Students will use web-based software to research and to evaluate transmission problems.

Methods of Evaluation

Method

Class Participation

Integration

Students will be required to participate in lab activities in a small group setting. Assessment of student performance will be based upon their ability to remove, repair and replace a manual transmission or transaxle in the amount of time prescribed in the manufacturer's published service information.

Method

Exams/Tests

Integration

The instructor will administer a final examination and may administer other examinations during the course of the semester. Questions will be presented in the style of an Automotive Service Excellence (ASE) certification exam and will be designed to assess the student's understanding of the theory of operation and proper procedures used to service and repair a manual transmission or transaxle.

Method

Final Performance

Integration

Students will be asked to diagnose and/or repair a fault with a manual transmission on a bugged vehicle. Students will be assessed on their ability to perform an accurate diagnosis and/or repair using procedures prescribed by the manufacturer's published service information and in the amount of time allotted by industry standard.

Method

Quizzes

Integration

Students will be required to complete the quizzes at the end of the assigned textbook chapters. Assessment will be based on the accuracy of the student responses.

Method

Papers

Integration

Students will be asked to prepare a two-to-three page paper discussing the contributions that members of special populations have made to the improvement of automotive technology, with a particular emphasis placed upon the effects experienced by the asset limited, income constrained, employed (ALICE) population. Assessment will be based on the accuracy of the information provided.

Assignments

Assignment Type

Reading

In-class and/or outside of class

Outside of class

Formative or Summative

Formative

Assignment

Read chapter 9 in Manual Drivetrains and Axles and be prepared to discuss the issues related to transmission or transaxle synchromesh operation and the effects that the lack of synchromesh would have in the overall practicality and accessibility of affordable transportation, particularly on the asset limited, income constrained, employed (ALICE) population.

Assignment Type
Writing

In-class and/or outside of class
In-class

Formative or Summative
Formative

Assignment
Prepare a repair order that conforms to State of California BAR standards and describes the repair process in terms of the "3Cs"; the customer complaint, the cause of the complaint, and the correction of the complaint.

Assignment Type
Other

In-class and/or outside of class
In-class

Formative or Summative
Summative

Assignment
Perform the diagnosis of a problem with one of the components of a manual transmission, propeller or half-shaft, final drive or transfer case on a bugged vehicle or manual transaxle trainer unit.

Assignment Type
Other

In-class and/or outside of class
In-class

Formative or Summative
Formative

Assignment
Assess the overall condition of a manual transmission or transaxle clutch assembly and perform any necessary adjustment or hydraulic bleeding procedures.

Course Materials

Textbooks
Jack Erjavec, Michael Ronan, and Justin Blevins (2026) Today's Technician: Manual Transmissions and Transaxles Classroom Manual, 8th Edition. Cengage. ISBN 978-035793-518-7

Johanson, Chris and Duffy, James E. (2021) Manual Drive Trains and Axles, 4th edition. Goodheart and Willcox. ISBN: 978-1-64564-168-1

Other Resources
ALLDATA and Mitchell ProDemand Online Repair Information
State of California Bureau of Automotive Repair's "Write it Right" Repair Order Preparation Guide, Revised February 2018.

Class Size Information

Class Size
24

Class Size Category
J - Specialty lab

Diversity and Inclusion

Course Design and Materials: Course will incorporate diverse perspectives, authors, and examples that reflect a variety of cultures, identities, and lived experiences. Instructional materials will be reviewed regularly to ensure representation, inclusivity, and alignment with equity-minded practices across disciplines.

Inclusive Learning Environment: Instructors will establish classroom norms and policies that promote respect, civil discourse, and belonging in both online and face-to-face classes. Clear expectations for communication and engagement will support a learning space where all students feel valued and heard.

Accessible Instruction: Course content will be delivered using accessible design. Materials will follow accessibility guidelines within the CMS, including captioned media, readable document formats, and multiple means of engagement to support diverse learning.

Equitable Teaching Practices: Instructors will use transparent and grading criteria, varied assessment methods, and timely feedback to promote fairness and student success. Opportunities for revision, reflection, and multiple demonstrations of learning may be incorporated when appropriate to the discipline.

Culturally Responsive Pedagogies: Instructional strategies will encourage critical thinking about diverse perspectives and systems of power relevant to the course content. Faculty will foster opportunities for students to connect course material to real-world contexts.

Ongoing Reflection and Improvement: Faculty will engage in continuous professional development related to IDEAA principles and reflect on course practices using metacognition to identify opportunities for increased equity, inclusion, and accessibility.

Explain how diversity and inclusion(e.g., gender, culture/race, sexuality, etc.) is infused into the course.
The automotive industry possesses a long and varied history of making practical transportation as inexpensive and as accessible as possible. One of the most important ways in which this was done was to improve the way that manual transmissions could be operated; originally, these types of gearboxes, which were at the time the only ones that were available, required rather special skills and a great deal of practice so that the operator could control the power and speed of the vehicle by shifting through the various gear ratios available to do so. This necessarily limited the accessibility to cheap and practical transportation to just a few wealthy or highly skilled individuals; the idea of having a set of helically-cut gears that are always in constant mesh equipped with synchromesh cones that matched the vehicle speed to the engine speed was the solution to this problem. This innovation was originally introduced in the 1930s, and because of it, millions of people were able to shift gears smoothly without the horrible crunching sound that accompanied the older "crash-box" type transmissions produced. The hypoid gears that could be employed by these new gearboxes featured much quieter, smoother operation; the result was the availability of transmissions that almost anyone could operate, with greatly extended durability and much quieter operation. This also had the effect of making the automobile cheaper to operate over the long term, thus making it a more accessible form of transportation for everyone; the less fortunate and less mechanically inclined were the primary beneficiaries of this invention. This course tells this part of the story about how the automotive industry made practical transportation accessible to virtually everyone, especially the asset limited, income constrained, employed population.

Describe how assignments, instruction, evaluation, course content, and interactions are contextualized for diverse learners promoting an equitable course.
The assignments utilized for the instruction of this course are diversified and designed to maximize the likelihood that students who possess any of the major learning styles will successfully complete the course. Much of the course is actually taught in the lab setting, for example; the instructor of the course will begin the lab session by demonstrating how a specific procedure is performed in order to make the students more comfortable with and more confident in their ability to perform the task themselves. Students will then be called upon to demonstrate their own abilities; while this is occurring, the instructor will be present to provide coaching and advice, as well as functioning as a kind of "safety valve" to smooth over any difficulties that individual students might encounter. This process will assist all learners, but is designed in particular to assist the kinesthetic learner to succeed in the overall course; since automotive technology is essentially an applied science, the student possessing that learning style will obviously be able to learn the scientific principles involved more effectively by participating in its direct application. Students who are more comfortable with the Visual or Auditory learning style will benefit the most from the accessible PowerPoint presentations and other accessible materials available through the CMS. The student who is the most comfortable being a reader or a writer will profit greatly by being exposed to the materials provided in the textbook for the course.

Quizzes based on the reading materials are assigned at regular intervals; in order to maximize student success and improve student learning opportunities and skills, multiple attempts at completion are always allowed. Both a written final examination and a final performance, or, "hands-on" evaluation are given equal weight so that students who possess any of the aforementioned learning styles will have the best chance to succeed. All of these assignments and assessments are weighted equally in final grading to maximize the opportunity for success for all students.
Finally, because of the limitations on workshop space and the amount of equipment available, students will need to interact with one another by working in teams of three to five; every effort is made on the part of the instructor of the course to include team members who will compliment each other in terms of abilities and skills so that the students will have not only the opportunity to succeed but also to learn from and assist each other.

Interactions

Explain how the course will incorporate student-to-student interaction.

The number of workstations available to our students is necessarily limited, so many of the tasks required to successfully complete the course will need to be performed by having the students work together in teams of three or four. We encourage diversity in these groups and try to engineer it into them; for example, we have experienced an influx of female students in recent years, and we have found that they are generally accepted into these teams with open arms. Simply put, they are usually the best students, for a variety of different reasons. Racial Diversity tends to be the norm rather than the exception in the automotive industry, so men of color tend to have equal representation. Our goal is to ensure that the students who compose these teams work in harmony with one another by the time the semester comes to a close; the industry we serve depends on a technician's ability to do this, and success is very difficult without this ability.

Explain how the course will incorporate instructor-to-student interaction.

The instructor's primary task is to demonstrate the proper procedures used to perform the various tasks required by this course such as disassembling a clutch assembly or a manual transmission gearset and successfully reassembling the units; this provides a considerable amount of interaction between the instructor and the students in the shop setting. The instructor is also physically present in the lab area while the students are completing their lab sheets and offers a significant amount of coaching about how the students might proceed to perform their tasks in an easier, safer or more efficient manner.

Explain how the course will incorporate student-to-content interaction.

The majority of this the time spent in this course is composed of performing actual physical tasks on manual transmissions or transaxles, final drive units and propeller shafts. Students will need to apply the concepts that they have learned through their reading assignments and during their classroom instruction and physical demonstration to the actions that they perform with their own hands. This aspect of the course incorporates student-to-content interaction in a way that few other courses are able to do.

Explain how the course will incorporate student-to-self interaction (metacognitive).

Success in manual transmission diagnosis and repair is assessed in two ways: on the quality of the repair and on whether the amount of time it takes to perform it conforms to generally accepted industry standards; this tends to encourage the student who is learning their craft to question the methods they are utilizing to perform diagnosis and repair tasks and to try to improve their own efficiency while doing so. The industry we serve provides powerful incentives, financial and otherwise, that encourage individuals to work in as intelligent a manner as possible; we introduce those incentives to the student as a part of this course.

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