LAUSD UNIFIED Division of Adult and Career Education

Career Technical Education (CTE) Course Outline

Course Title:	Auto Tech: Manual Drive Train & Axles
Course Number:	79-90-78
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 drive train diagnosis, clutch diagnosis and repair, transmission/transaxle diagnosis and repair, drive shaft and half shaft, universal and constant velocity (CV) joint diagnosis and repair, drive axle diagnosis and repair: ring and pinion gears and differential case assembly, drive axle diagnosis and repair: limited slip differential, drive axle diagnosis and repair: drive axle shaft, four-wheel drive/all-wheel drive component 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. Duffy, James E., Johanson, C. Manual Drive Trains And Axles, Training Series for ASE Certification, 4th Edition, Goodheart-Willcox Publisher, 2021.
Link to Resource Folder	https://bit.ly/autotechdriveresources

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 manual drive train and axles 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 repair and maintenance sector.	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 requirements for auto technicians to maintain a safe and healthy working environment. 3. Discuss the impact of Environmental Protection Agency (EPA) legislation on Transportation	**Career Ready Practice:** 1, 2, 10, 12 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3

(3 hours)	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.	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 c. personnel	**Career Ready Practice:** 1, 2, 7 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 Responsibility & Flexibility: 7.1, 7.4

(1 hour)	3. Pass a resource management assessment with an 80% score or higher.	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 use, maintenance, storage techniques for automotive tools and equipment. .	1. Define, discuss, and demonstrate the proper use, maintenance, and storage techniques for the following specialty tools and equipment for the manual drive train and axles: a. axle nut socket set (or equivalent) b. clutch alignment set c. clutch pilot bearing/ puller set/installer d. differential setup tools (appropriate for units being taught) e. front wheel drive engine support fixture f. rotating torque wrench (beam-type or equivalent) g. transaxle removal and installation equipment	**Career Ready Practice:** 1, 2, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 Health & Safety: 6.4

(6 hours)	h. special tools for transmissions/transaxles (appropriate for units being taught) i. transmission/transaxle holding fixtures j. transmission jack(s) k. universal joint tools l. pneumatic tools: forks, punches, ball joint remover 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 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.	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 DRIVE TRAIN DIAGNOSIS Understand, apply, and evaluate the general diagnostic techniques for drive trains according to manufacturer's specifications.	1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. 2. Identify and interpret drive train concern; determine necessary action. 3. Demonstrate how to research applicable vehicle and service information, such as drive train system operation, fluid type, vehicle service	**Career Ready Practice:** 1, 2, 4, 5, 9, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5

(12 hours)	history, service precautions, and technical service bulletins. 4. Locate and interpret vehicle and major component identification numbers. 5. Form teams to diagnose fluid loss, level, and condition concerns; determine necessary action. 6. Drain and fill manual transmission/transaxle and final drive unit. 7. Pass a general drive train diagnosis assessment with an 80% score or higher.	Technology: 4.1, 4.2, 4.3, 4.5 Problem Solving & Critical Thinking: 5.2, 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.5, C2.6, C3.3, C4.1, C4.3, C4.4, C5.1, C5.6, C8.2, C8.6
H. CLUTCH DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for clutches according to manufacturer's specifications.	1. Demonstrate how to diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action. 2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action. 3. Inspect hydraulic clutch slave and master cylinders, lines, and hoses; determine necessary action. 4. Inspect and replace clutch pressure plate assembly, clutch disc, release (throw-out) bearing and linkage, and pilot bearing/bushing (as applicable). 5. Form teams to bleed the clutch hydraulic system. 6. Inspect flywheel and ring gear for wear and cracks; determine necessary action. 7. Inspect engine block, core plugs, rear main engine oil seal, clutch (bell) housing, transmission/transaxle case mating surfaces, and alignment dowels; determine necessary action. 8. Measure flywheel runout and crankshaft end play; determine necessary action. 9. Pass a clutch 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: 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.3 Demonstration & Application: 11.1

(25 hours)		**CTE Pathway:** C2.2, C2.5, C5.1, C5.6, C8.2, C8.6
I. TRANSMISSION/TRANSAXLE DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for transmissions/transaxles according to manufacturer's specifications. (24 hours)	1. Form teams to diagnose common manual transmission problems: a. noise b. difficult shifting c. gear clash d. fluid condition e. jumping out of gear 2. Demonstrate how to remove and install standard manual transmission from the vehicle. 3. Assemble, disassemble, and inspect manual transmission. 4. Inspect, adjust, lubricate: a. manual transmission linkage b. shift assemblies c. brackets and bushings/grommets d. cables, pivots, and levers 5. Inspect and adjust input and output shafts, bearings, and retainers; determine necessary action. 6. Measure and adjust bearing preload or endplay; determine necessary action. 7. Inspect, test, and replace transmission sensors, actuators, switches using a scan tool; determine necessary action. 8. Pass a transmission/transaxle 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, 4.3 Problem Solving & Critical Thinking: 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.3, C2.4, C2.5, C8.2, C8.6
J. DRIVE SHAFT AND HALF SHAFT, UNIVERSAL AND CONSTANT VELOCITY (CV) JOINT DIAGNOSIS AND REPAIR Understand, apply, and evaluate the recovery, recycling, and handling techniques for the drive shaft, half shaft, universal joint, and	1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action. 2. Demonstrate how to diagnose universal joint noise and vibration concerns; perform necessary action. 3. Form teams to remove and replace front wheel drive (FWD) front wheel bearing. 4. Inspect, service, and replace shafts, yokes, boots, and CV joints. 5. Inspect, service, and replace shaft center support bearings.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2

constant-velocity joint according to the manufacturer's specifications. (12 hours)	6. Check shaft balance and phasing; measure shaft runout; measure and adjust driveline angles. 7. Pass a drive shaft and half shaft, universal and constant velocity (CV) joint diagnosis and repair assessment with an 80% score or higher.	Problem Solving & Critical Thinking: 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.4, C2.5, C5.1, C5.6, C8.2, C8.6
K. DRIVE AXLE DIAGNOSIS AND REPAIR: RING AND PINION GEARS AND DIFFERENTIAL CASE ASSEMBLY Understand, apply, and evaluate the diagnostic and repair techniques for the ring and pinion gears and the differential cases according to the manufacturer's specifications.	1. Diagnose noise and vibration concerns; determine necessary action. 2. Demonstrate how to diagnose fluid leakage concerns; determine necessary action. 3. Inspect and replace companion flange and pinion seal; measure companion flange runout. 4. Inspect ring gear and measure runout; determine necessary action. 5. Form teams to remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings. 6. Measure and adjust drive pinion depth. 7. Measure and adjust drive pinion bearing preload. 8. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types). 9. Check ring and pinion tooth contact patterns; perform necessary action. 10. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case. 11. Reassemble and reinstall differential case assembly; measure runout; determine necessary action.	**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, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.3 Demonstration & Application: 11.1 **CTE Pathway:**

(12 hours)	12. Pass a drive axle diagnosis and repair: ring and pinion gears and differential case assembly assessment with an 80% score or higher.	C2.2, C2.4, C2.5, C8.2
L. DRIVE AXLE DIAGNOSIS AND REPAIR: LIMITED SLIP DIFFERENTIAL Understand, apply, and evaluate the diagnostic and repair techniques for the limited slip differential according to the manufacturer's specifications. (10 hours)	1. Demonstrate how to diagnose noise, slippage, and chatter concerns; determine necessary action. 2. Form teams to clean and inspect differential housing; refill with correct lubricant and/or additive. 3. Inspect and reinstall limited slip differential components. 4. Measure rotating torque; determine necessary action. 5. Pass a drive axle diagnosis and repair: limited slip differential 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: 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2,5, C8.6
M. DRIVE AXLE DIAGNOSIS AND REPAIR: DRIVE AXLE SHAFT Understand, apply, and evaluate the diagnostic and repair techniques for the drive axle shaft according to the manufacturer's specifications.	1. Demonstrate how to diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action. 2. Form teams to inspect and replace drive axle shaft wheel studs. 3. Remove and replace drive axle shafts. 4. Inspect and replace drive axle shaft seals, bearings, and retainers. 5. Measure drive axle flange runout and shaft end play; determine necessary action. 6. Pass a drive axle diagnosis and repair: drive axle shaft 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: 5.3, 5.4

(10 hours)		Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.5, C5.1, C8.2, C8.6
N. FOUR-WHEEL DRIVE/ALL-WHEEL DRIVE COMPONENT DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques for the four-wheel drive/all-wheel drive components according to the manufacturer's specifications. (20 hours)	1. List the basic parts and demonstrate a four-wheel drive system. 2. Explain the difference between four-wheel drive variations: a. four-wheel drive b. all-wheel drive c. front wheel drive d. rear wheel drive 3. Explain the construction and operation of a transfer case and check fluid levels. 4. Form teams to diagnose drive system noise, vibration, leakage, and steering problems. 5. Pass a four-wheel drive/all-wheel drive component 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, 4.3 Problem Solving & Critical Thinking: 5.2, 5.3, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.1, 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.5, C8.2, C8.6

O. 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 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	**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 and Skills: 10.1, 10.3 Demonstrate and Application: 11.1, 11.2, 11.5 **CTE Pathway:** C5.4, C5.5

(4 hours)	c. industry associations and/or organized labor	
P. 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

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