

# YOSEMITE REGIONAL OCCUPATIONAL PROGRAM

## AUTOMOTIVE SERVICE TECHNICIAN I and II

CBEDS Codes: 5668

### JOB TITLES

### DOT NO.

Technician Trainee	620.684-014
Automotive Transmission/Transaxle Technician	620.281-062
Brake Technician	620.281-026
Electrical Systems Technician	620.281-030
Engine Performance Technician	620.281-066
Engine Repair Technician	620.261-010
Manual Drive Train & Axle Technician	620.261-010

### **Course description:**

The "Automotive Service Technician" course is a comprehensive automotive program. The course will serve high school and adult students that meet age, grade level, and boundary requirements. Students will receive instruction in component identification, diagnosis and replacement, precision measuring, rebuilding and repair, adjustment and servicing procedures. Instruction will provide students with entry level skills in automatic transmission, transaxle, brakes, electrical systems, engine performance, engine repair, heating and air conditioning, manual drive train and axles, and front-end repair. The advanced course will include core standards and basic principles. Instruction will include basic lecture, demonstration, and live hands-on work. Evaluation will be academic and competency based.

### *Prerequisites:*

Student will read at 7th grade level.  
Student will complete 5th grade math (fractions, division)  
Instructor approval required

DURATION: up to 360 total hours

CREDIT:

MEETS UNIVERSITY OF CALIFORNIA ENTRANCE REQUIREMENTS: No

MEETS CALIFORNIA STATE UNIVERSITY REQUIREMENTS: No

### ARTICULATED WITH POSTSECONDARY INSTITUTIONS:

<i>High School</i>	<i>College</i>	<i>College Course Articulated</i>
Patterson High School	Modesto Junior College	AUTEC 311
Riverbank High School	Modesto Junior College	AUTEC 311
Turlock High School	Modesto Junior College	AUTEC 311

**Instructional Content**

Instruction will include:

**Student Outcomes**

At the end of instruction, the student will be able to:

**Hours**

CL=Classroom  
CC=Comm. Class.

<p><b>1. Automotive Industry Overview.</b></p> <ol style="list-style-type: none"> <li>1. Components of auto industry</li> <li>2. Alternative forms of transportation utilized in automobile manufacturing, &amp; other aspects of land transportation systems.</li> <li>3. Review Careers/Job Market/Employability</li> <li>4. Leadership/management.</li> <li>5. System analysis &amp; problem solving.</li> </ol>	<p><b>Goal: The student will understand the general principles of automobile manufacturing &amp; the auto industry.</b></p> <ol style="list-style-type: none"> <li>A. Understand components of the auto industry.</li> <li>B. Recognize automotive as a business.</li> <li>C. Understand the operation of pipelines, conveyors, &amp; elevators as methods to transport materials for automobile manufacturing, &amp; land transportation systems.</li> <li>D. Define &amp; demonstrate Careers/Job Market/Employability.</li> <li>E. Participate in leadership/management.</li> <li>F. Understand the need for leadership &amp; management in the field.</li> <li>G. Analyze systems within the field, solve problems.</li> </ol>	<p><b>Anchor/CR</b></p> <p>2.0-2.6 3.0-3.9 4.1-4.5 5.0-5.4 7.0-7.8 8.0-8.7 9.0-9.7 10.0-10.4 11.0-11.5</p> <p><b>CR</b> 1,2,3,4,5,7,8,9,10 and 12</p>	<p><b>CTE</b></p> <p>C4.0-C4.4 C5.0-C5.6</p>	<p><b>CL-I</b></p> <p>5-10</p>	<p><b>CC</b></p>	<p><b>CL-II</b></p>	<p><b>CC</b></p>
<p><b>2. Safety.</b></p> <ol style="list-style-type: none"> <li>1. General shop safety.</li> <li>2. Proper clothing &amp; grooming.</li> <li>3. Safe use of hand &amp; power tools.</li> <li>4. Restraint systems.</li> <li>5. Emergency fire &amp; disaster procedures.</li> <li>6. OSHA rules &amp; regulations.</li> <li>7. Waste &amp; material disposal.</li> </ol>	<p><b>Goal: Student will understand the health hazards, safety practices, &amp; environmental hazards related to their work in the shop.</b></p> <ol style="list-style-type: none"> <li>A. Comply with shop safety.</li> <li>B. Wear eye protection.</li> <li>C. Describe proper clothing &amp; grooming.</li> <li>D. Use hand &amp; power tools safely.</li> <li>E. Understand the relationship of glass &amp; structural crushing to the proper deployment of air bags.</li> <li>F. Understand safe operation &amp; repair procedures for active, passive, &amp; supplemental air-bag restraint systems.</li> <li>G. Will be able to inspect, remove, &amp; replace active &amp; passive restraints, deploy supplemental restraints, &amp; verify the proper operation of restraint systems.</li> <li>H. Follow emergency fire &amp; disaster procedures.</li> <li>I. Comply with OSHA rules &amp; regulations.</li> <li>J. Handle &amp; dispose of materials safely.</li> </ol>	<p>2.0-2.6 5.0-5.4 6.0-6.7 7.2-7.4 7.7 8.0-8.7 9.0-9.3 9.6 9.7 10.0-10.4 11.0-11.5</p> <p><b>CR</b> 1,2,5,6,7,8,9,10,11 and 12</p>	<p>C1.0-C1.5 C2.0-C2.7 C3.5 C3.7 C4.0-C4.2 C5.0-C5.2</p>	<p>5-10</p>			
<p><b>3. Tools, Equipment &amp; Supplies.</b></p> <ol style="list-style-type: none"> <li>1. Review basic hand tools, operation &amp; maintenance.</li> <li>2. Review basic power tools, operation &amp; maintenance.</li> <li>3. Review basic supplies storage &amp; maintenance.</li> <li>4. Review basic equipment storage &amp; maintenance.</li> <li>5. Pertinent business practices.</li> </ol>	<p><b>Goal: The student will understand how specific tools are used to perform maintenance &amp; repair operations, &amp; will select &amp; use the correct tools &amp; equipment for repair procedures</b></p> <ol style="list-style-type: none"> <li>A. Identify, select, operate, store, &amp; maintain hand &amp; power tools.</li> <li>B. Identify select, store, maintain supplies &amp; equipment.</li> <li>C. Follow business practice, i.e., planning, management, and budget.</li> </ol>	<p>2.4-2.6 5.0-5.4 6.0-6.7 7.0 7.6 7.7 8.0-8.7 9.0-9.3 9.6 9.7 10.0-10.4 11.0-11.5</p> <p><b>CR</b> 1,2,5,6,7,8,9,10,11 and 12</p>	<p>C1.0-C1.5 C2.0-C2.7 C5.0-C5.2 C5.4 C5.5</p>	<p>10-20</p>			

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<p><b>4. Scientific Principles.</b>                      1. Math related to auto field.                      2. Measurement scales &amp; systems used in transportation &amp; energy operations                      3. Physics, power, &amp; energy related to the automotive &amp; transportation field.                      4. Alternative forms of energy &amp; transportation, including nuclear power, aerospace, &amp; electric automobiles.                      5. Review energy &amp; transportation related environmental safety &amp; health issues.                      6. Basic principles of electricity &amp; electronics .</p>	<p><b>Goal: The student will understand scientific principles in relation to physical &amp; chemical functions in transportation &amp; energy systems.</b>                      A. Demonstrate auto related math.                      B. Understand measurement scales &amp; systems used in transportation &amp; energy operations.                      C. Follow industry-approved standards when using the measuring tools &amp; measurement systems required in diagnostic &amp; adjustment procedures.                      D. Describe related physics, power, &amp; energy                      E. Understand mechanical principles in relation to transportation &amp; energy.                      E. Understand the basic principles of nuclear energy.                      F. Understand &amp; describe the potential application of alternative power sources.                      G. Understand basic scientific principles in relation to aerospace transportation systems.                      H. Understand the effects of transportation vehicles on the environment.                      I. Understand &amp; use the basic principles of electricity power, &amp; electronics</p>	<p><b>Anchor/CR</b>                       1.0                      1.0-1.6                      5.0-5.4                      6.0                      -6.7                      7.2                      7.3                      7.4                      7.7                      10.0-10.4                      11.0                      11.1   <b>CR</b>                      1,4,5,6,7 and 12</p>	<p><b>CTE</b>                       C1.0                      C1.1                      C1.3                      C1.4                      C1.5                      C3.0-C3.7                      C6.0                      C7.0                      C8.0                       CR                      1,4,5,6,7, and 12</p>	<p><b>CL-I</b>                       5-20</p>	<p><b>CC</b>                       0</p>	<p><b>CL-II</b></p>	<p><b>CC</b></p>
<p><b>5. Communication Skills.</b>                      1. Applying written communication skills in auto industry, including appointments, cost estimates, work orders, and using service manuals</p>	<p><b>Goal: The student will be able to apply verbal communication skills in the auto industry.</b>                      A. Schedule appointments.                      B. Prepare cost estimates.                      C. Prepare work orders.                      D. Prepare &amp; close repair orders.                      E. Use service manuals &amp; other information retrieval systems for diagnostic procedures.                      F. Understand the need for maintenance &amp; document maintenance procedures.                      G. Understand fault diagnosis &amp; the steps that lead to fault diagnosis, &amp; inspect &amp; analyze the cause of component failure.                      H. Understand the business practices of a shop, &amp; generate &amp; maintain service records in a manner consistent with current legal &amp; industry requirements.</p>	<p>1.0                      2.0-2.6                      4.0-4.6                      5.0-5.4                      7.0-7.8                      8.0-8.7                      10.0-10.4                      11.0-11.5   <b>CR</b>                      1,2,4,5,7,8,10,11 and 12</p>	<p>C2.3                      C2.6                      C4.0-C4.4                      C5.0-C5.6</p>	<p>3-10</p>	<p>3-5</p>		

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6. Brake Systems.	<b>Goal: The student will understand basic &amp; antilock braking-system components, parts &amp; functions.</b>	<b>Anchor/CR</b>	<b>CTE</b>	<b>CL-I</b>	<b>CC</b>	<b>CL-II</b>	<b>CC</b>
<ol style="list-style-type: none"> <li>1. Brake system operation.</li> <li>2. Disc &amp; drum brakes.</li> <li>3. Hydraulic &amp; pneumatic systems &amp; power.</li> <li>5. Adjusting &amp; service procedures.</li> <li>6. Bleed (manual, pressure, vacuum or surge) brake system:</li> <li>7. Flush hydraulic system.</li> <li>8. Demonstrate diagnosing brake problems and determination of repairs.</li> <li>9. Monitor and assist student with removal, cleaning, and inspection of brake drums.</li> <li>10. Illustrate use of lathe machine in relationship to brake drums.</li> <li>11. Monitor student removal, cleaning, and inspection of brake shoes and other hardware.</li> <li>12. Monitor student removal/reinstallation of wheel cylinders.</li> <li>13. Discuss brake shoe/parking brake pre-adjustments</li> <li>14. Demonstrate installation of wheel torque and lug nuts</li> <li>15. Monitor final check and adjustments of brakes</li> <li>16. Monitor removal of caliper assembly and inspection for damage.</li> <li>17. Monitor cleaning/inspection of mountings and slides.</li> <li>18. Demonstrate removal/cleaning and determining needed service on hardware.</li> <li>19. Monitor reassembly, lubrication and reinstallation of caliper pads, and related hardware.</li> <li>20. Illustrate cleaning, inspection and measurement of rotor with dial indicator.</li> <li>21. Discuss manufacturer's recommendations</li> <li>22. Monitor adjustment of calipers</li> </ol>	<ol style="list-style-type: none"> <li>A. Understand disc &amp; drum brake system operation.</li> <li>B. Understand the physical principles of mechanical &amp; hydraulic brakes, &amp; pneumatic power.</li> <li>C. Explain deterioration, wear, &amp; failure, &amp; the service procedures required.</li> <li>D. Understand the process of bleeding a brake system.</li> <li>E. Flush hydraulic system.</li> </ol> <p><b>Brakes</b></p> <ol style="list-style-type: none"> <li>F. Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation problems: determine needed repairs</li> <li>G. Remove, clean (using proper safety procedures), inspect, and measure brake drums. Service/replace as needed.</li> <li>H. Mount brake drum on lathe: machine Braking surface.</li> <li>I. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters, self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.</li> <li>J. Removal/reinstallation of wheel cylinders</li> <li>K. Understand pre-adjust of brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings.</li> <li>L. Reinstallation of wheel, torque lug nuts.</li> <li>M. Make final check and adjustments of brakes.</li> </ol> <p><b>Disc Brake Diagnosis and Repair</b></p> <ol style="list-style-type: none"> <li>N. Removal of caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing.</li> <li>O. Clean and inspect mounting and slides for wear and damage.</li> <li>P. Remove, clean and remaining hardware, determine needed service.</li> <li>Q. Disassemble and clean caliper assembly;</li> </ol>	<p>1.0 4.0-4.4 4.6 5.0-5.4 6.0-6.7 7.0-7.4 7.7 10.0- 10.4 11.0- 11.5</p> <p><b>CR</b> 1,4,5,6,7 10, 11 and 12</p>	<p>C1.0-C1.5 C2.0-C2.7 C3.0 C3.3 C3.4 C3.5 C3.6 C3.7 C4.0-C4.4 C7.0 C7.1 C7.7 C8.0 C8.1 C8.3 C8.6</p>	<p>10-50</p>	<p>5-10</p>		<p>5-10</p>

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6. Brake Systems.(Cont.)	<b>Goal: The student will understand basic &amp; antilock braking-system components, parts &amp; functions.(Continued)</b>	Anchor /CR	CTE	CL-I	CC	CL-II	CC
<p>23. Monitor filling of master cylinder with fluids and seat pads</p> <p>24. Demonstrate reinstallation of wheel and torque lug nuts.</p> <p>25. Demonstrate removal and replacement rotor.</p> <p>26. Demonstrate test pedal free.</p> <p>27. Identify vacuum supply and vacuum power booster.</p> <p>28. Identify and demonstrate inspection of power booster.</p> <p>29. Demonstrate inspection of power type boosters.</p> <p>30. Diagnose and Identify wheel- bearing noises.</p> <p>31. Demonstrate removal and repack of wheel bearings.</p> <p>32. Identify parking brake checks for corrosion, rust; demonstrate cleaning and replacement.</p> <p>33. Review inspection, operation and adjustment of parking brake.</p> <p>34. Demonstrate replacement of wheel bearing and race.</p>	<p><b>inspect parts for wear, rust scoring and damage; replace seal, boot, and damaged or worn parts.</b></p> <p>R. Reassemble. Lubricate, and reinstall caliper pads, and related hardware.</p> <p>S. Clean, inspect, and measure rotor with a dial indicator and a micrometer</p> <p>T. Manufacturer's recommendations in determining need to machine or replace rotors</p> <p>U. Adjust calipers with integrated parking brake system.</p> <p>V. Fill master cylinder with fluid and seat pads; inspect caliper for leaks.</p> <p>W. Reinstall wheel, torque lug nuts, and make final checks and adjustments</p> <p>X. Remove and replace rotor.</p> <p><b>Power Assist Units Diagnosis and Repair</b></p> <p>Y. Test pedal free travel with; check power assist operation.</p> <p>Z. Check vacuum supply to vacuum type power booster.</p> <p>AA. Inspect vacuum-type power booster.</p> <p>BB. Inspect the check valve; repair or replace parts.</p> <p><b>Miscellaneous Diagnosis and Repair</b></p> <p>CC. Diagnose wheel bearing noises, wheel shimmy, and vibration problems; determine needed repairs</p> <p>DD. Remove, clean, inspect, repack and reinstall wheel bearings.</p> <p>EE. Check parking brake cables for wear, rusting, binding and corrosion, clean, lubricate and replace as needed.</p> <p>FF. Check parking brake operation; adjust as needed.</p> <p>GG. Check operation of parking brake indicator light system.</p> <p>HH. Check operation of brake stop light system</p> <p>II. Replace wheel bearing and race.</p> <p><b>Anti-lock Brake System</b></p> <p>JJ. Inspect, test and service anti-lock brake system (ABS) hydraulic, electrical and mechanical components.</p> <p>KK. Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise problems; determine needed repairs.</p> <p>LL. Define anti-lock brake system (ABS), warning lights at startup.</p> <p>MM. Diagnose anti-lock brake system (ABS) electronic control (s) and components using self-diagnosis and/or recommended test equipment.</p>						

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<p><b>7. Engine Performance - Drivability Testing.</b>                      1. General engine diagnosis of performance.                      1. Ignition system testing procedures.                      2. Fuel system-testing procedures.                      3. Emissions control systems &amp; testing procedures.                      4. Vacuum routing procedures.                      5. Diagnostic &amp; testing procedures.                      6. Final adjustments.</p>	<p><b>Goal: The student will understand basic engine performance system functions &amp; testing.</b>                      A. Test ignition systems.                      B. Test fuel systems.                      C. Explain &amp; test functions of vehicle emission control systems.                      D. Perform vacuum routing procedures.                      E. Complete diagnostic &amp; testing procedures.                      F. Perform final adjustments.</p>	<p><b>Anchor/CR</b>                      1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7,10,11, and 12</p>	<p><b>CTE</b>                      C1.0-C1.5                      C2.0-C2.7                      C3.0                      C3.1                      C3.5-                      C3.7                      C4.0-C4.4                      C6.0-                      C6.4                      C7.0-C7.1                      C7.7</p>	<p><b>CL-I</b>                      15-45</p>	<p><b>CC</b>                      5-10</p>	<p><b>CL -II</b></p>	<p><b>CC</b></p>
<p><b>8. Heating &amp; Air Conditioning.</b>                      1. Overview of heating &amp; refrigeration system operations.                      2. Define, describe &amp; identify major components of a heating &amp; refrigeration system.</p>	<p><b>Goal: The student will understand heating &amp; refrigeration system operations.</b>                      A. Understand the refrigeration cycle &amp; its application in automotive air conditioning systems.                      B. Understand the operation of electrical &amp; vacuum/mechanical controls in heating &amp; air conditioning systems.                      C. Understand the operation of &amp; test procedures for diagnosing heating &amp; air conditioning controls.                      D. Define, describe and/or identify these components: receiver dryer; condenser; compressor; evaporator; heater core; radiator function; blower motor.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7,10,11, and 12</p>	<p>C3.0                      C3.2                      C3.5-C3.7                      C8.0                      C8.1                      C8.4                      C8.6</p>	<p>2-5</p>	<p>0-10</p>		
<p><b>9. Suspension &amp; Steering.</b>                      1. Long arm &amp; short arm operation.                      2. Rack &amp; pinion operation.                      3. Define, describe, &amp; identify major suspension &amp; steering components.</p>	<p><b>Goal: The student will know the basic parts of the suspension &amp; steering system, &amp; understand their function.</b>                      A. Recognize long arm, short arm operation.                      B. Understand rack &amp; pinion operation.                      C. Identify steering component.                      D. Define coil spring.                      E. Describe leaf spring.                      F. Explain shock absorbers.                      G. Define Macpherson struts.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7,10,11, and 12</p>	<p>C3.0                      C3.3                      C3.5-C3.7                      C8.0                      C8.1                      C8.2                      C8.6</p>	<p>7-15</p>	<p>0</p>		
<p><b>10. Automatic Transmission &amp; Transaxle Repair.</b>                      1. Diagnostic procedures.                      2. Maintenance &amp; adjustments.                      3. In-vehicle service &amp; repair.                      4. Off-vehicle service &amp; repair.                      5. Gear train, shafts, case &amp; bushings.                      6. Oil pump &amp; converter.                      7. Friction &amp; reaction units.</p>	<p><b>Goal: The student will understand basic diagnosis, maintenance &amp; adjustment, &amp; service of automatic transmissions &amp; transaxles.</b>                      A. Verifying complaint &amp; proper operation.                      B. Understand diagnostic procedures for fluids, pressures, stall, torque converters, electrical /electronic components &amp; vacuum.                      C. Understand maintenance &amp; adjustment procedures; perform periodic maintenance &amp; adjustments on linkages &amp; cables, bands, fluid levels, &amp; electronic-control circuits.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7,10,11, and 12</p>	<p>C3.0                      C3.3                      C3.5                      C3.7                      C7.0                      C7.1                      C7.7                      C7.7                      C8.0                      C8.1                      C8.2                      C8.6</p>				

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<p><b>10. Automatic Transmission &amp; Transaxle Repair. (Continued)</b></p>	<p>D. Understand in-vehicle service: service seals, gaskets, governors, valve body, &amp; electronic components. E. Understand off-vehicle service: remove &amp; install transmission, transaxle, &amp; torque converter; disassemble &amp; reassemble transmission &amp; transaxle; test torque converter lock-up. F. Analyze, maintain/replace, &amp; assemble: end play, thrust washers &amp; bearings, oil delivery seal rings, bearings, gears, sprockets, &amp; chains G. Analyze, maintain/replace, &amp; assemble: flex plate, pump drive, stator clutch, oil pump, transmission cooling system. H. Analyze, maintain/replace, &amp; assemble: clutch, clutch pack, servo, roller &amp; sprag clutches, bands &amp; drums.</p>	<p><b>Anchor/CR</b>  1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0-10.4 11.0-11.5  <b>CR</b> 1,2,5,6,7,10,11, and 12</p>	<p><b>CTE</b></p>	<p><b>CL-I</b>  10-50</p>	<p><b>CC</b>  5-10</p>	<p><b>CL-II</b></p>	<p><b>C C</b></p>
<p><b>11. Electrical Systems: General Diagnosis &amp; Repair.</b> 1. Wiring diagrams. 2. Continuity tests. 3. Measuring voltage &amp; current flow. 4. Continuity &amp; resistance analysis. 5. Shorts, grounds, opens &amp; high resistance repair. 6. Fusible links, circuit breakers &amp; fuses maintenance.</p>	<p><b>Goal: The student will understand how to diagnose &amp; repair automotive electrical systems. The student will check, test, diagnose, repair &amp; adjust electrical systems &amp; components.</b> A. Analyze wiring diagrams. B. Operate continuity tests. C. Measure voltage drop. D. Measure applied voltage. E. Measure current flow. F. Analyze continuity &amp; resistance. G. Repair shorts, grounds, opens &amp; high resistance. H. Maintain/replace fusible links, circuit breakers &amp; fuses.</p>	<p>1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0-10.4 11.0-11.5  <b>CR</b> 1,2,5,6,7,10,11, and 12</p>	<p>C3.0 C3.4-C3.7 C7.0-C7.7</p>	<p>5-10</p>	<p>5-10</p>		
<p><b>12. Electrical Systems: Diagnosis &amp; Service of Batteries.</b> 1. State of charge diagnosis. 2. Battery capacity measurement. 3. Three-minute charge test. 4. Cables, connectors, &amp; clamps maintenance. 5. Battery removal &amp; installation.</p>	<p><b>Goal: The student will understand battery operation, testing, &amp; servicing procedures.</b> A. Diagnose state of charge. B. Measure battery capacity (load test) C. Complete three minute charge test. D. Maintain &amp; replace cables, connectors, &amp; clamps.</p>	<p>1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0-10.4 11.0-11.5  <b>CR</b> 1,2,5,6,7,10,11, and 12</p>	<p>C3.0 C3.4-C3.7 C7.0 C7.1 C7.2C7.7</p>	<p>5-10</p>	<p>5-10</p>		

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<b>13. Electrical Systems: Diagnosis &amp; Repair of Starting Systems.</b> 1. Current draw test. 2. Voltage drop test. 3. Maintenance of switches, connectors, & wires. 4. Maintenance of starter relays & solenoids. 5. Maintenance of starter motors.	<b>Goal: The student will understand the operation of, testing of, &amp; repair procedures for starting systems.</b> A. Analyze current draw test. B. Analyze voltage drop test. C. Operate/maintain/replace switches, connectors, & wires. D. Maintain/repair/replace starter relays & solenoids. E. Maintain/repair/replace starter motors.	<b>Anchor/CR</b>  1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0- 10.4 11.0- 11.5  <b>CR</b> 1,2,5,6,7, 10,11, and 12	<b>CTE</b>  C3.0 C3.4-C3.7 C7.0 C7.1 C7.2C7.3 C7.7	<b>CL-I</b>  5-10	<b>CC</b>  0-5	<b>CL-II</b>	<b>CC</b>
<b>14. Electrical Systems: Diagnosis &amp; Repair of Charging Systems.</b> 1. Drive belts, pulleys, & fans. 2. Connectors & wires. 3. Charging system output tests. 4. Maintenance of voltage regulators. 5. Maintenance of alternators. 6. Diode test.	<b>Goal: The student will understand the operation of, testing of, &amp; repair procedures for charging systems.</b> A. Assess drive belts, pulleys & fans. B. Assess connectors & wires. C. Analyze charging system output tests. D. Measure/repair voltage regulators. E. Test/maintain/repair alternators. F. Complete diode test.	1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0- 10.4 11.0- 11.5  <b>CR</b> 1,2,5,6,7, 10,11, and 12	C3.0 C3.4-C3.7 C7.0 C7.1 C7.2C7.3 C7.7	5-20	5-10		
<b>15. Electrical Systems: Diagnosis &amp; Repair of Lighting Systems.</b> 1. Headlight maintenance. 2. Dimmer switches maintenance. 3. Relays, sockets, connectors, & wires maintenance. 4. Retractable headlight assembly's maintenance. 5. Wiring circuits maintenance. 6. Dash lights maintenance. 7. Stop lights maintenance. 8. Turn signals maintenance. 9. Back up lights maintenance. 10. Emergency lights maintenance.	<b>Goal: The student will understand the operation, diagnosis, &amp; repair of automotive lighting systems.</b> A. Assess/maintain/repair/replace headlights. B. Assess/maintain/repair/replace dimmer switches. C. Assess/maintain/repair/replace relays, sockets, connectors, & wires. D. Assess/maintain/repair/replace retractable headlight assemblies. E. Assess/maintain/repair/replace wiring circuits. F. Assess/maintain/repair/replace dash lights. G. Assess/maintain/repair/replace stop lights. H. Assess/maintain/repair/replace turn signals. I. Assess/maintain/repair/replace back-up lights. J. Assess/maintain/repair/replace emergency lights.	1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0- 10.4 11.0- 11.5  <b>CR</b> 1,2,5,6,7, 10,11, and 12	C3.0 C3.4-C3.7 C7.0C7.4 C7.7	5-10	5-10		



**Instructional Content**

Instruction will include:

**Student Outcomes**

At the end of instruction, the student will be able to:

**Hours**

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Instructional Content	Student Outcomes	Anchor/ CR	CTE	CL-I	CC	CL-II	CC
<p><b>16. Electrical Systems: Diagnosis &amp; Repair of Driver-Information Systems.</b></p> <ol style="list-style-type: none"> <li>1. Gauges maintenance.</li> <li>2. Sending units maintenance.</li> <li>3. Connectors, printed circuit boards, &amp; wiring circuits maintenance.</li> <li>4. Digital dashboard maintenance.</li> </ol>	<p><b>Goal: The student will understand the operation of &amp; diagnostic procedures for meters, gauges, warning lamps &amp; devices, relays &amp; related electrical circuits.</b></p> <ol style="list-style-type: none"> <li>A. Operate/maintain/assess/install gauges.</li> <li>B. Operate/maintain/assess/install sending units.</li> <li>C. Operate/maintain/assess/install connectors, printed circuit boards, &amp; wiring circuits.</li> <li>D. Operate/maintain/assess/install digital dashboards.</li> </ol>	<p>1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0-10.4 11.0-11.5</p> <p><b>CR</b> 1,2,5,6,7,10,11, and 12</p>	<p>C3.0 C3.4-C3.7 C7.0C7.1 C7.7</p>	<p>2-5</p>	<p>2-5</p>		
<p><b>17. Electrical Systems: Diagnosis &amp; Repair of Horns, Wipers &amp; Washers.</b></p> <ol style="list-style-type: none"> <li>1. Horn relay maintenance.</li> <li>2. Horn button assembly maintenance.</li> <li>3. Instruments maintenance.</li> <li>4. Connectors &amp; wiring circuit maintenance.</li> <li>5. Wiper delay speed control maintenance.</li> <li>6. Wiper park switch maintenance.</li> <li>7. Wiper motor maintenance.</li> <li>8. Washer pumps maintenance.</li> <li>9. Hose circuits maintenance.</li> </ol>	<p><b>Goal: The student will understand horn &amp; windshield-wiper circuits, diagnostic techniques, &amp; component-testing procedures.</b></p> <ol style="list-style-type: none"> <li>A. Operate/maintain/assess/install horn relays.</li> <li>B. Operate/maintain/assess/install horn button assembly.</li> <li>C. Operate/maintain/assess/install instrument.</li> <li>D. Operate/maintain/assess/install connectors &amp; wiring circuit.</li> <li>E. Operate/maintain/assess/install wiper delay speed control.</li> <li>F. Operate/maintain/assess/install wiper park switch.</li> <li>G. Operate/maintain/assess/install wiper motor.</li> <li>H. Operate/maintain/assess/install washer pumps.</li> <li>J. Operate/maintain/assess/install hose circuits.</li> </ol>	<p>1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0-10.4 11.0-11.5</p> <p><b>CR</b> 1,2,5,6,7,10,11, and 12</p>	<p>C3.0 C3.4-C3.7 C7.0C7.1 C7.6 C7.7</p>	<p>2-5</p>	<p>2-5</p>		
<p><b>18. Electrical Systems: Diagnosis &amp; Repair of Body-Electronics Systems.</b></p> <ol style="list-style-type: none"> <li>1. Power window maintenance.</li> <li>2. Power sunroof maintenance.</li> <li>3. Power seats maintenance.</li> <li>4. Rear window defogger maintenance.</li> <li>5. Electric door/trunk locks maintenance.</li> <li>6. Remote door locks maintenance.</li> <li>7. Convertible tops maintenance.</li> <li>8. Load leveling assemblies maintenance.</li> </ol>	<p><b>Goal: The student will understand the operation of, diagnosis of, &amp; testing procedures for computer controlled body-electronics systems.</b></p> <ol style="list-style-type: none"> <li>A. Assess/maintain/repair power windows.</li> <li>B. Assess/maintain/repair power sunroofs.</li> <li>C. Assess/maintain/repair power seats.</li> <li>D. Assess/maintain/repair rear window defogger.</li> <li>E. Assess/maintain/repair electric door/trunk locks.</li> <li>F. Assess/maintain/repair remote door locks.</li> <li>G. Assess/maintain/repair convertible tops.</li> <li>H. Assess/maintain/repair load leveling assemblies.</li> </ol>	<p>1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0-10.4 11.0-11.5</p> <p><b>CR</b> 1,2,5,6,7,10,11, and 12</p>	<p>C3.0 C3.4-C3.7 C7.0C7.1 C7.7</p>	<p>2-5</p>	<p>2-5</p>		

**Instructional Content**

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<p><b>19. Alternative Fuel Vehicles</b>                      1. Need for alternative fuels.                      2. Alternative fuel legislation                      3. Alternative fuel and advanced technology forms of transportation.</p>	<p><b>Goal: The student will understand the general principles of alternative and advanced technology vehicles.</b>                      A. Understand the economical and environmental impacts of current and alternative fuels and advanced technology vehicles.                      B. Understand basic legislation that affects vehicle fuels and emissions and mandates alternative fuels.                      C. Understand the manufacture of alternative fuels such as electricity, ethanol, propane, natural gas and biodiesel.                      D. Understand the drivetrain configurations for alternative fuels such as electricity, ethanol, propane, natural gas and biodiesel.                      E. Understand the drivetrain of advanced technology vehicles such as hybrids and fuel cells.</p>	<p><b>Anchor/CR</b>                      1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5   <b>CR</b>                      1,2,5,6,7, 10,11, and 12</p>	<p><b>CTE</b>                      C3.0                      C3.4-C3.7                      C7.0                      C7.1                      C7.7</p>	<p><b>CL-I</b>                      5-10</p>	<p><b>CC</b>                      0</p>	<p><b>CL-II</b></p>	<p><b>CC:</b></p>
<p><b>20. Engine Repair: General Diagnosis of Engines.</b>                      1. Receive &amp; verify customer complaints.                      2. Vacuum tests.                      3. Cylinder power balance test.                      4. Compression test.                      5. Cylinder leakage test.</p>	<p><b>Goal: The student will understand how to diagnose automotive engines; interpret complaints, &amp; inspect &amp; test engines to determine needed repairs.</b>                      A. Verify customer complaints, fluid leaks, engine noises, excessive oil consumption.                      B. Perform vacuum tests.                      C. Complete cylinder power balance test.                      D. Demonstrate compression test.                      E. Display cylinder leakage test.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5   <b>CR</b>                      1,2,5,6,7, 10,11, and 12</p>	<p>C3.0                      C3.1                      C3.6                      C6.0-C6.4                      C7.7</p>	<p>10-20</p>	<p>10-20</p>		
<p><b>21. Engine Repair: Removal &amp; Reinstallation of Engines.</b>                      1. Front- &amp; rear-wheel-drive engines removal &amp; reinstallation.</p>	<p><b>Goal: The student will understand how to remove engines &amp; replace them in front- and rear-wheel-drive vehicles.</b>                      A. Remove &amp; install front- and rear-wheel drive engines in accordance with industry standards.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5   <b>CR</b>                      1,2,5,6,7, 10,11, and 12</p>	<p>C3.0                      C3.7                      C6.0-C6.4</p>	<p>2-5</p>	<p>2-5</p>		

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<p><b>22. Engine Repair: Diagnosis &amp; Repair of Cylinder Heads.</b> 1. Crack test. 2. Surface warpage inspection. 3. Blocked passages inspection. 4. Install cylinder head.</p>	<p><b>Goal: The student will understand the diagnosis of cylinder heads &amp; procedures for their repair.</b> A. Analyze crack test. B. Inspect surface warpage. C. Inspect blocked passages. D. Installation of cylinder head.</p>	<p><b>Anchor/CR</b>  1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0- 10.4 11.0- 11.5  <b>CR</b> 1,2,5,6,7, 10,11, and 12</p>	<p><b>CTE</b>  C3.0 C3.1 C3.7 C6.0-C6.4</p>	<p><b>CL-I</b>  5-10</p>	<p><b>CC</b>  2-5</p>	<p><b>CL-II</b></p>	<p><b>CC</b></p>
<p><b>23. Engine Repair: Diagnosis &amp; Repair of Valve Trains.</b> 1. Valve train component review. 2. Valve spring squareness inspection. 3. Valve spring pressure measurement. 4. Valve spring free height calculation. 5. Spring retainers, locks &amp; grooves assessment. 6. Valve stem seals analysis. 7. Valve guides inspection. 8. Valve seats assessment. 9. Push rods analysis. 10. Rocker arms &amp; pivots inspection. 11. Hydraulic/mechanical lifters assessment. 12. Camshaft journals &amp; bearings analysis 13. Valve train installation. 14. Valve adjustment. 15. Camshaft timing calculation.</p>	<p><b>Goal: The student will understand how to diagnose &amp; repair valve-train assemblies.</b> A. Know valve train components. B. Inspect valve spring squareness. C. Measure valve spring pressure. D. Calculate valve spring free height. E. Assess spring retainers, locks &amp; grooves. F. Analyze valve stem seals. G. Inspect valve guides. H. Assess valve seats. I. Analyze push rods. J. Inspect rocker arms &amp; pivots. K. Assess hydraulic/mechanical lifters. L. Analyze camshaft journals &amp; bearings. M. Follow valve train installation procedures. N. Adjust valves. O. Calculate camshaft training.</p>	<p>1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0- 10.4 11.0- 11.5  <b>CR</b> 1,2,5,6,7, 10,11, and 12</p>	<p>C3.0 C3.1 C3.7 C6.0-C6.4</p>	<p>10- 20</p>	<p>10- 20</p>		
<p><b>24. Engine Repair: Diagnosis &amp; Repair of Engine Blocks.</b> 1. Pans, covers, gaskets &amp; seals inspection. 2. Examining for cracks. 3. Oil passages assessment. 4. Threads inspection. 5. Cylinder walls examination. 6. Crankshaft, crank check, journal damage, &amp; journal measurements inspection &amp; measurement. 7. Bearings analysis. 8. Pistons assessment &amp; piston rings inspection. 9. Harmonic balance examination. 10. Flywheel inspection. 11. Pilot bearing assessment. 12. Shaft assembly's examination. 13. Honing &amp; reaming cylinder walls. 14. Engine block reassembly procedures.</p>	<p><b>Goal: The student will understand how to diagnose &amp; repair engine blocks.</b> A. Inspect pans, covers, gaskets &amp; seals. B. Examine for cracks. C. Assess oil passages. D. Inspect threads. E. Examine cylinder walls. F. Inspect &amp; measure crankshaft, crank check, journal damage, journal measurements. G. Analyze bearings. H. Assess pistons; inspect piston rings. I. Examine harmonic balance. J. Inspect flywheel. K. Assess pilot bearing. L. Examine shaft assemblies. M. Hone &amp; ream cylinder walls. N. Reassemble engine block.</p>	<p>1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0- 10.4 11.0- 11.5  <b>CR</b> 1,2,5,6,7, 10,11, and 12</p>	<p>C3.0 C3.1 C3.7 C6.0-C6.4</p>	<p>30- 40</p>	<p>1-5</p>		

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<p><b>25. Engine Repair: Diagnosis of Lubrication &amp; Cooling Systems.</b>                      1. Oil pressure testing &amp; inspection.                      2. Oil pump assemblies inspection.                      3. Pressure test cooling system examination.                      3. Drive belts &amp; hoses assessment &amp; testing</p>	<p><b>Goal: The student will understand how to diagnose lubrication &amp; cooling systems.</b>                      A. Inspect &amp; test oil pressure.                      B. Inspect oil pump assemblies.                      C. Examine pressure test-cooling system.                      D. Assess &amp; test-drive belts &amp; hoses.</p>	<p><b>Anchor/CR</b>                      1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-                      10.4                      11.0-                      11.5   <b>CR</b>                      1,2,5,6,7,                      10,11,                      and 12</p>	<p><b>CTE</b>                      C3.0                      C3.1                      C3.3                      C3.7                      C6.0-C6.4</p>	<p><b>CL-I</b>                      10-                      12</p>	<p><b>CC</b>                      10-                      12</p>	<p><b>CL</b>                      -II</p>	<p><b>CC</b></p>
<p><b>26. Engine Repair: Bolt-on Installation.</b>                      1. Water pump installation.                      2. Thermostat replacement.                      3. Starter installation.                      4. Alternator placement.                      5. Intake &amp; exhaust manifold installation.                      6. Fuel delivery system placement.</p>	<p><b>Goal: The student will understand the installation of bolt-on installation in engine repair.</b>                      A. Install water pump.                      B. Replace thermostat.                      C. Demonstrate starter installation.                      D. Display alternator placement.                      E. Perform intake &amp; exhaust manifold installation.                      F. Complete fuel delivery system placement.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-                      10.4                      11.0-                      11.5   <b>CR</b>                      1,2,5,6,7,                      10,11,                      and 12</p>	<p>C3.0                      C3.7                      C6.0-C6.4</p>	<p>2-5</p>	<p>2-5</p>		
<p><b>27. Manual Drive Trains &amp; Axles: Clutch Diagnosis &amp; Repair.</b>                      1. Verifying customer complaints.                      2. Pedal, linkage adjusters diagnostics &amp; repair.                      3. Throw-out bearing assemblies diagnostics &amp; repair.                      4. Clutch plate &amp; pressure plate diagnostics &amp; repair.                      5. Pilot bearing/bushing diagnostics &amp; repair.                      6. Flywheel &amp; ring gear diagnostics &amp; repair.</p>	<p><b>Goal: The student will understand how to diagnose &amp; repair clutch systems.</b>                      A. Verify customer complaints.                      B. Diagnose, repair pedal, linkage adjusters.                      C. Diagnose, repair throw-out bearing assemblies.                      D. Diagnose, repair clutch plate &amp; pressure plate.                      E. Diagnose, repair pilot bearing/bushing.                      F. Diagnose, repair flywheel &amp; ring gear.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-                      10.4                      11.0-                      11.5   <b>CR</b>                      1,2,5,6,7,                      10,11,                      and 12</p>	<p>C3.0                      C3.7                      C8.0                      C8.1                      C8.2                      C8.6</p>	<p>5-10</p>	<p>5-10</p>		

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<p><b>28. Manual Drive Train &amp; Axles: Transmission Diagnosis &amp; Repair.</b>                      1. Verifying customer complaints.                      2. Shift linkage assembly's assessment &amp; repair.                      3. Power train mounts examination/repair.                      4. Gaskets, seals &amp; sealing surfaces inspection &amp; repair.                      5. Transmission removal &amp; replacement.                      6. Transmission disassembly procedures.                      7. Shifter assembly's diagnostics &amp; repair.                      8. Input shaft bearings diagnostics &amp; repair.                      9. Main shaft, gears, thrust washers &amp; bearings assessment &amp; repair.                      10. Synchronizer hub assembly's inspection repair.                      11. Counter (cluster) gear assemblies examination &amp; repair.                      12. Reverse idler gear assembly's diagnostics &amp; repair.                      13. Extension housing inspection &amp; repair.                      14. Speedometer gears assessment &amp; repair.</p>	<p><b>Goal: The student will understand the diagnosis &amp; repair of automotive transmission systems.</b>                      A. Verify customer complaints.                      B. Assess &amp; repair shift linkage assemblies.                      C. Examine &amp; repair power train mounts.                      D. Inspect/repair gaskets, seals, &amp; sealing surfaces.                      E. Remove &amp; replace transmission.                      F. Follow transmission disassembly procedures.                      G. Diagnose &amp; repair shifter assemblies.                      H. Diagnose &amp; repair input shaft bearings.                      I. Assess &amp; repair main shaft, gears, thrust washers &amp; bearings.                      J. Inspect &amp; repair synchronizer hub assemblies.                      K. Examine/repair counter (cluster) gear assemblies.                      L. Diagnose &amp; repair reverse idler gear assemblies.                      M. Inspect &amp; repair extension housing.                      N. Assess &amp; repair speedometer gears.</p>	<p><b>Anchor/CR</b>                       1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-                      10.4                      11.0-                      11.5   <b>CR</b>                      1,2,5,6,7                      ,10,11,                      and 12</p>	<p><b>CTE</b>                       C3.0                      C3.7                      C8.0-C8.2                      C8.6</p>	<p><b>CL-I</b>                       5-10</p>	<p><b>CC</b></p>	<p><b>CL -II</b></p>	<p><b>CC</b>                       5-10</p>
<p><b>29. Manual Drivetrain &amp; Axles.</b>                      1. Overview of transmission operation.                      2. Transaxle operation.                      3. Define, describe, &amp; identify major drive train &amp; axles components.</p>	<p><b>Goal: The student will know the basic parts of the drivetrain &amp; understand their function</b>                      A. Understand transmission operation.                      B. Identify &amp; describe the failures &amp; malfunctions that can occur in the drivetrainsystem.                      C. Define, describe &amp; identify the following components: drive axles; CV joints; drive shafts; universal joints; differentials.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-                      10.4                      11.0-                      11.5   <b>CR</b>                      1,2,5,6,7                      ,10,11,                      and 12</p>	<p>C3.0                      C3.7                      C8.0-C8.2                      C8.6</p>	<p>5-10</p>	<p>0</p>		
<p><b>30. Manual Drive Train &amp; Axles: Transaxle Diagnosis &amp; Repair.</b>                      1. Transaxle final drive diagnostics &amp; repair.                      2. Measure pre-load assessment &amp; repair.                      3. CV joints &amp; drive axles examination &amp; repair.                      4. Transaxle removal &amp; replacement.                      5. Spider gears inspection &amp; repair.                      6. Pinion gear assemblies examination &amp; repair.                      7. Differential side bearings diagnostics &amp; repair.</p>	<p><b>Goal: The student will understand the diagnosis techniques &amp; repair procedures for transaxles.</b>                      A. Diagnose &amp; repair transaxle final drive.                      B. Assess &amp; repair measure pre-load.                      C. Examine &amp; repair CV joints &amp; drive axles.                      D. Remove &amp; replace transaxle.                      E. Inspect &amp; repair spider gears.                      F. Examine &amp; repair pinion gear assemblies.                      G. Diagnose &amp; repair differential side bearings.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-                      10.4                      11.0-                      11.5   <b>CR</b>                      1,2,5,6,7                      ,10,11,                      and 12</p>	<p>C3.0                      C3.7                      C8.0-C8.2                      C8.6</p>	<p>2-5</p>	<p>2-5</p>		

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<p><b>31. Manual Drive Train &amp; Axles: Drive Shafts &amp; Universal Joints.</b>                      1. Front &amp; rear wheel drive shafts diagnostics &amp; repair.                      2. Center support bearings diagnostics &amp; repair.                      3. Universal joints removal &amp; replacement.                      4. Testing shaft balance &amp; run out.</p>	<p><b>Goal: The student will understand the theory &amp; practice of diagnosing noise &amp; vibration in front- and rear-wheel drive shafts &amp; universal/constant velocity joints &amp; determine appropriate repairs.</b>                      A. Diagnose/repair front &amp; rear wheel drive shafts.                      B. Diagnose/repair center support bearings.                      C. Remove &amp; replace universal joints.                      D. Test shaft balance &amp; run out.</p>	<p><b>Anchor/CR</b>                      1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7, 10,11, and 12</p>	<p><b>CTE</b>                      C3.0                      C3.7                      C8.0-C8.2                      C8.6</p>	<p><b>CL-I</b>                      2-5</p>	<p><b>CC</b>                      2-5</p>	<p><b>CL-II</b></p>	<p><b>CC</b></p>
<p><b>32. Manual Drive Trains &amp; Axles: Differentials.</b>                      1. Companion flange &amp; pinion seal preparation.                      2. Ring gear run-out measurement.                      3. Pinion gear &amp; bearing driving.                      4. Pinion bearing pre-load calculation.                      5. Side bearing pre-load measurement.                      6. Ring &amp; pinion tooth contact pattern assessment.                      7. Differential assembly &amp; disassembly.</p>	<p><b>Goal: The student will understand the theory &amp; practice of diagnosing a conventional differential unit.</b>                      A. Prepare companion flange &amp; pinion seal.                      B. Measure ring gear run-out.                      C. Drive pinion gear &amp; bearing.                      D. Calculate pinion bearing pre-load.                      E. Measure side bearing pre-load.                      F. Assess ring &amp; pinion tooth contact pattern.                      G. Assemble &amp; disassemble differential.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7, 10,11, and 12</p>	<p>C3.0                      C3.7                      C8.0-C8.2                      C8.6</p>	<p>5-10</p>	<p>2-5</p>		
<p><b>33. Manual Drive Train &amp; Axles: Limited-Slip Differentials.</b>                      1. Clutch (cone/plate) components assessment &amp; repair.                      2. Rear wheel rotating torque calculation.</p>	<p><b>Goal: The student will understand the operation of limited-slip differentials.</b>                      A. Assess/repair clutch (cone/plate) components.                      B. Calculate rear wheel-rotating torque.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7, 10,11, and 12</p>	<p>C3.0                      C3.7                      C8.0-C8.2                      C8.6</p>	<p>5</p>	<p>5</p>		
<p><b>34. Manual Drive Train &amp; Axles: Axle Shafts.</b>                      1. Axle shaft removal.                      2. Seals, bearings, &amp; retainers inspection &amp; repair.                      3. Axle flange run-out measurement.                      4. Shaft end play examination &amp; repair.</p>	<p><b>Goal: The student will understand the causes of axle noises, vibrations, &amp; seal-leakage.</b>                      A. Remove axle shaft.                      B. Inspect, repair seals, bearings, &amp; retainers.                      C. Measure axle flange run-out.                      D. Examine &amp; repair shaft end play.</p>	<p>1.0                      4.0-4.4                      4.5                      5.0-5.4                      6.0-6.7                      7.0                      7.4                      7.7                      10.0-10.4                      11.0-11.5  <b>CR</b>                      1,2,5,6,7, 10,11, and 12</p>	<p>C3.0                      C3.7                      C8.0-C8.2                      C8.6</p>	<p>2-5</p>	<p>2-5</p>		

**Instructional Content**

Instruction will include:

**Student Outcomes**

At the end of instruction, the student will be able to:

**Hours**CL=Classroom  
CC=Comm. Class.

<b>35. Manual Drive Train &amp; Axles: Four Wheel Drive.</b>	<b>Goal: The student will understand the operating principles of a four-wheel drive transfer case.</b>	<b>Anchor/ CR</b>	<b>CTE</b>	<b>CL-I</b>	<b>CC</b>	<b>CL-II</b>	<b>CC</b>
<ol style="list-style-type: none"> <li>1. Transfer case removal &amp; installation.</li> <li>2. Shifter assembly's diagnostics &amp; repair.</li> <li>3. Front drive propeller shafts examination &amp; correcting.</li> <li>4. Steering knuckles assessment &amp; placement.</li> <li>4. Locking hubs &amp; bearing examination &amp; repair.</li> </ol>	<ol style="list-style-type: none"> <li>A. Remove &amp; install transfer case.</li> <li>B. Diagnose &amp; repair shifter assemblies.</li> <li>C. Examine &amp; correct front drive propeller shafts.</li> <li>D. Assess &amp; place steering knuckles.</li> <li>E. Examine &amp; repair locking hubs &amp; bearings.</li> </ol>	1.0 4.0-4.4 4.5 5.0-5.4 6.0-6.7 7.0 7.4 7.7 10.0-10.4 11.0-11.5  <b>CR</b> 1,2,5,6,7, 10,11, and 12	C3.0 C3.7 C8.0-C8.2 C8.6	10	2-10		