LAUSD UNIFIED Division of Adult and Career Education

Career Technical Education (CTE) Course Outline

Course Title:	Auto Tech: Engine Performance/1
Course Number:	79-90-68
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 is one in a sequence of two courses. It provides students with technical instruction and practical experience in an automobile 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, engine designs, basic automotive electricity, general engine diagnosis, computerized engine controls diagnosis and repair, ignition system diagnosis and repair, exhaust system, fuel systems, emissions systems, and employability skills and resume preparation. 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 **introductory/concentrator** 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. VanGelder, Kirk. Fundamentals of Automotive Technology Principles & Practices, 3rd Edition. Jones & Bartlett Learning, 2023.
Link to Resource Folder	https://bit.ly/engineperformance1resources

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 engine performance 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		

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
Understand safety procedures and techniques in the auto repair and maintenance sector. (3 hours)	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 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.	**Career Ready Practice:** 1, 2, 10, 12 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 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

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
C. RESOURCE MANAGEMENT Understand, apply, and evaluate the resource management principles and techniques in the auto repair and maintenance field. (1 hour)	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 3. Pass a resource management assessment with an 80% score or higher.	**Career Ready Practice:** 1, 2, 7 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 Responsibility & Flexibility: 7.1, 7.4 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.	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	**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

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(2 hours)	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.	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: a. four or five gas exhaust analyzer (five gas recommended) b. fuel injection pressure gauge sets with adapters c. injector pulse tester d. leak detector (smoke or nitrogen) e. logic probe (suggested) f. oxygen sensor socket g. pinch-off pliers h. sending unit socket(s) i. spark plug thread tap j. spark tester k. timing advance light l. vacuum/pressure gauge m. Digital Storage Oscilloscope (DS0) n. scanners o. memory saver p. chemicals q. automotive hand tools r. power tools and equipment s. multimeter t. soldering tools 2. Explain and demonstrate the following: a. selection of the appropriate hand, power tools, and equipment for each job	**Career Ready Practice:** 1, 2, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 Health & Safety: 6.4 Technical Knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** C2.2, C2.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	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.	
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. ENGINE DESIGNS Understand, apply, and evaluate the principles of engine design found in automobiles.	1. Define the following terms: a. engine b. Top Dead Center (TDC) c. Bottom Dead Center (BDC) d. piston stroke 2. Work with teams to research and identify the major parts of an automobile engine. 3. Describe the basic function of each of the major parts of an automobile engine.	**Career Ready Practice:** 1, 2, 4, 5, 9, 11 **CTE Anchor:** Academics: 1.0 Communications:

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	4. Explain the two-stroke, four-stroke cycle, and rotary engine of an internal combustion engine. 5. Describe the features and functions of the different types of cylinder configurations. 6. Explain the advantages and disadvantages of various cylinder configurations to interpret information and draw conclusions. 7. Describe the features and functions of the following types of valve arrangements: a. overhead valve b. overhead cam c. double overhead cam d. multiple valve heads 8. Pass an engine designs assessment with an 80% score or higher.	2.1, 2.3 Technology: 4.1, 4.3, 4.5 Problem Solving & Critical Thinking: 5.4 Leadership & Teamwork: 9.3, 9.7 Technical Knowledge & Skills: 10.1, 10.3 **CTE Pathway:** C2.1, C2.5, C3.1, C5.1, C6.3
H. BASIC AUTOMOTIVE ELECTRICITY Understand the fundamentals of electricity as it is used in automobiles.	1. Define the following: a. electricity b. current c. conductor d. resistance e. inductance f. voltage 2. Identify devices used in measuring electricity. 3. Describe and demonstrate Ohm's Law problems. 4. Compare the similarities and differences between alternating current (AC) and direct current (DC). 5. Identify electrical circuits and their components. 6. Describe magnetism. 7. Describe how electricity can be generated. 8. List electrical systems found in cars. 9. Describe an automotive storage battery.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3 Technology: 4.5 Problem Solving & Critical Thinking: 5.3, 5.4 Leadership & Teamwork:

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 hours)	10. Form teams to interpret information and draw conclusions when testing an automotive storage battery. 11. Describe the function of fuses. 12. Research, list, and describe the different types of electrical accessories and their function. 13. Pass a basic automotive electricity assessment with an 80% score or higher.	9.3, 9.7 Technical Knowledge & Skills: 10.1, 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C2,2, C2.3, C2.4, C2.7, C3.5, C4.3, C7.2
I. GENERAL ENGINE DIAGNOSIS Understand, apply, and evaluate the diagnostic techniques for engines.	1. Define the following terms: a. volume metric efficiency b. misfire c. fuel trims 2. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. 3. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. 4. Identify and interpret engine performance concern; determine necessary action. 5. List the steps of the diagnostic process. 6. Locate and interpret vehicle and major component identification numbers and verify the complaint. 7. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. 8. Diagnose abnormal engine noise or vibration concerns; determine necessary action.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.1, 4.2, 4.3, 4.5 Problem Solving & Critical Thinking: 5.2, 5.4 Leadership & Teamwork: 9.3, 9.7 Demonstration & Application: 11.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(30 hours)	9. Diagnose abnormal exhaust color, odor, and sound; determine necessary action. 10. Perform engine absolute (vacuum/boost) manifold pressure tests and smoke test; determine necessary action. 11. Perform cylinder power balance test; determine necessary action. 12. Perform cylinder cranking and running compression tests; determine necessary action. 13. Form teams and perform a cylinder leakage test; determine necessary action. 14. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns; determine necessary action. 15. Prepare 4 or 5 gas analyzers; inspect and prepare a vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action. 16. Verify engine operating temperature; determine necessary action. 17. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. 18. Verify correct camshaft and crankshaft timing using the lab scope. 19. Pass a general engine diagnosis assessment with an 80% score or higher.	**CTE Pathway:** C2.3, C2.5, C2.6, C3.5, C4.4, C6.2, C6.4, C7.1
J. COMPUTERIZED ENGINE CONTROLS DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques	1. Define the following terms: a. input processing b. output processing c. open and close loops d. analog and digital signals 2. Retrieve and record diagnostic trouble codes, OBD monitor status, and freeze frame data; clear codes when applicable. 3. Diagnose the causes of emissions or drivability concerns with stored or active diagnostic	**Career Ready Practice:** 1, 2, 4, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
for computerized engine controls. . (30 hours)	trouble codes; obtain, graph, and interpret scan tool data. 4. Diagnose emissions or drivability concerns without stored diagnostic trouble codes; determine necessary action. 5. Check for module communication (including CAN/BUS systems) errors using a scan tool. 6. Inspect and test computerized engine control system sensors, powertrain/engine control module (PCM/ECM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action. 7. Access and use service information to perform step-by-step diagnosis. 8. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action. 9. Form teams and perform active tests of actuators using a scan tool; determine necessary action. 10. Describe the importance of running all OBDII monitors for repair verification. 11. Pass a computerized engine controls diagnosis and repair assessment with an 80% score or higher.	Technology: 4.1, 4.3, 4.4 Problem Solving & Critical Thinking: 5.2, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical knowledge & Skills: 10.3 Demonstration & Application: 11.1 **CTE Pathway:** C1.5, C2.1, C2.3, C2.6, C6.3, C6.4
K. IGNITION SYSTEM DIAGNOSIS AND REPAIR Understand, apply, and evaluate the diagnostic and repair techniques	1. Define the following terms: a. primary and secondary circuit b. electrical induction c. step up transformer d. ignition timing e. firing order f. spark plug 2. Explain the operative principles of an automotive ignition system.	**Career Ready Practice:** 1, 2, 5, 9, 10 **CTE Anchor:** Academics: 1.0 Communications:

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
for the ignition system. (30 hours)	3. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions concerns; determine necessary action. 4. Distinguish between coil, coil pack, distributorless and direct ignition system. 5. Form teams to inspect and test ignition primary and secondary circuit wiring and solid-state components; test ignition coil(s); perform necessary action. 6. Inspect and test crankshaft and camshaft position sensor(s); perform necessary action. 7. Inspect, test, and/or replace ignition control module, powertrain/engine control module; reprogram, as necessary. 8. Pass an ignition system diagnosis and repair assessment with an 80% score or higher.	2.1, 2.3, 2.5 Problem Solving & Critical Thinking: 5.2, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical knowledge & Skills: 10.1 Demonstration & Application: 11.1 **CTE Pathway:** C2.3, C2.7, C3.1, C3.5, C3.7, C6.4, C7.7
L. **EXHAUST SYSTEM** Understand, apply, and evaluate the diagnostic and repair techniques for the exhaust system.	1. Define the following terms: a. oxygen and air fuel sensors b. catalytic converter c. muffler d. exhaust back pressure e. tail pipes f. resonator 2. Describe the basic parts and construction of an exhaust system. 3. Explain the exhaust manifold and heat risers. 4. Explain the importance of working in a well-ventilated area e.g., carbon monoxide and the appropriate handling and disposal of hazardous materials. 5. Form teams and compare exhaust system design properties to make informed decisions.	**Career Ready Practice:** 1, 2, 4, 5, 9, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2, 4.3 Problem Solving & Critical Thinking:

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(6 hours)	6. Pass an exhaust system assessment with an 80% score or higher.	5.3, 5.4 Health & Safety: 6.6, 6.7 Leadership & Teamwork: 9.3, 9.7 Technical knowledge & Skills: 10.1 **CTE Pathway:** C1.3, C5.2
M. FUEL SYSTEMS Understand, apply, and evaluate the diagnostic and repair techniques for the fuel systems.	1. Define, explain, and demonstrate the different types of fuel terms: a. gasoline b. diesel c. Compressed Natural Gas (CNG) d. propane e. hydrogen f. ethanol g. methanol 2. State safety rules and working on the fuel supply system. 3. Define the major components of the fuel supply system. 4. Describe the operation of mechanical and electrical fuel pumps. 5. Describe the construction and action of air filters. 6. Form teams and explain the test used to diagnose problems with fuel pumps, fuel filters, and fuel lines by using reference materials. 7. Research and summarize how crude oil is converted into gasoline, diesel fuel, and other products. 8. Inspect, solve, repair fuel lines, and replace the fuel hoses.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10, 11 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.2, 4.3, 4.5 Problem Solving & Critical Thinking: 5.2, 5.4 Leadership & Teamwork: 9.3, 9.7 Technical knowledge & Skills:

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(10 hours)	9. Pass a fuel assessment with an 80% score or higher.	10.1 Demonstration & Application: 11.1 **CTE Pathway:** C2.3, C2.5, C3.1, C3.4, C4.3, C6.2, C6.4, C7.7
N. **EMISSIONS SYSTEMS** Understand, apply, and evaluate the diagnostic and repair techniques for the emissions systems.	1. Define and explain emission terms: a. smog b. Hydrocarbons (HC) c. carbon monoxide (CO) d. carbon dioxide (CO2) e. oxides of nitrogen (NOX) f. particulates g. Exhaust Gas Recirculation (EGR) h. Positive Crankcase Ventilation (PCV) i. Secondary Air Injection (AIR) 2. Define the fundamental terms relating to an automobile emission control system. 3. Explain the source of air pollution. 4. Describe the operation principles of the emission control system. 5. Compare the different designs of emission control systems. 6. Explain and demonstrate how the computer for the engine control module can be used to operate the emission control system. 7. Form teams to interpret EGR related scan tool data and diagnostic trouble codes to determine needed repairs. 8. Research, inspect, service, and replace PCV valves, breather caps, tubes, and hoses by using technical reports, manuals, etc. 9. Summarize how OBD II system uses oxygen multiple sensors to check air fuel mixture and catalytic efficiency.	**Career Ready Practice:** 1, 2, 4, 5, 9, 10, 11, 12 **CTE Anchor:** Academics: 1.0 Communications: 2.1, 2.3, 2.5 Technology: 4.1, 4.3, 4.5 Problem Solving & Critical Thinking: 5.3 Leadership & Teamwork: 9.3, 9.7 Technical knowledge & Skills: 10.1 Demonstration & Application: 11.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(15 hours)	10. Pass an emissions systems assessment with an 80% score or higher.	**CTE Pathway:** C2.1, C2.2, C2.3, C2.5, C2.6, C2.7, C3.1, C4.3
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.	**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 and Flexibility: 7.2, 7.3, 7.4, 7.7 Ethics & Legal Responsibilities: 8.3, 8.4, 8.5 Leadership & Teamwork:

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(4 hours)	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 c. industry associations and/or organized labor	9.1, 9.2, 9.3, 9.4, 9.6, 9.7 Technical Knowledge & Skills: 10.1, 10.3 Demonstration & Application: 11.1, 11.2, 11.5 **CTE Pathway:** C5.4, C5.5

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