Course Outline

Transportation **REVISED: August/2017**

Job Title
Auto Technician

Career Pathway:
Systems Diagnostics and Service

Industry Sector:
Transportation

O*NET-SOC CODE:
49-3023.02

CBEDS Title:
Advanced Automotive

CBEDS No.:
5669

79-90-61

Auto Tech: Electrical and Electronics / 1

Credits: 15 **Hours:** 180

Course Description:
This competency-based course is one in a sequence of courses designed to meet the Automotive Service Excellence (ASE) Program Certification Standards set by the National Automotive Technicians Education Foundation (NATEF). It provides students with technical instruction and practical experience in an automobile area incorporating sustainable and green vehicle technologies. Instruction includes classroom and workplace policies and procedures in accordance with federal, state, and local safety and environmental regulations. It covers the proper use, maintenance, and storage of auto repair tools and equipment as well as the effective use of service manuals and computer-based information systems. Emphasis is placed on the techniques in the following areas of electrical and electronic diagnosis and repair: general diagnosis of domestic and import cars, battery, starting system, and charging system. It also teaches trade mathematics, resource management, and employability 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 the Auto Tech: Engine Repair (79-90-73) course.

NOTE: For Perkins purposes this course has been designated as an **introductory/concentrator** course.

MEETS NATEF STANDARDS AND IDENTIFIES PRIORITY TASKS IN ELECTRICAL/ELECTRONICS SYSTEMS. CHECK THE NATEF MANUAL FOR EXPLANATION OF PRIORITY 1, 2, OR 3 TASKS.

This course cannot be repeated once a student receives a Certificate of Completion.

Los Angeles Unified School District
Division of Adult and Career Education
Instructional and Couseling Services Unit
Adult Curriculum Office
www.wearedace.org

COURSE OUTLINE COMPETENCY-BASED COMPONENTS

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

COURSE OUTLINE COMPONENTS	**LOCATION**
GOALS AND PURPOSES	Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

PERFORMANCE OBJECTIVES OR COMPETENCIES	pp. 7-14

Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

COURSE OUTLINE COMPETENCY-BASED COMPONENTS (continued)

COURSE OUTLINE COMPONENTS	LOCATION
INSTRUCTIONAL STRATEGIES	p. 16
Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom. Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.	
UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT	Cover
The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level. Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.	pp. 7-14
EVALUATION PROCEDURES	pp. 16-17
The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved. Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.	
REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT	Cover
After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.	

ACKNOWLEDGMENTS

Thanks to PAUL PIDOUX and MARCELA BAKER for developing and editing this curriculum. Acknowledgment is also given to ERICA ROSARIO for designing the original artwork for the course covers.

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1.0 Academics
Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Transportation academic alignment matrix for identification of standards.

2.0 Communications
Acquire and accurately use Transportation sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management
Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology
Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Transportation sector workplace environment.

5.0 Problem Solving and Critical Thinking
Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Transportation sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety
Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Transportation sector workplace environment.

7.0 Responsibility and Flexibility
Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Transportation sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities
Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork
Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization

10.0 Technical Knowledge and Skills
Apply essential technical knowledge and skills common to all pathways in the Transportation sector, following procedures when carrying out experiments or performing technical tasks.

11.0 Demonstration and Application
Demonstrate and apply the knowledge and skills contained in the Transportation anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

C. Systems Diagnostics and Service Pathway

The Systems Diagnostics and Service pathway prepares students for postsecondary education and employment in the transportation industry, which includes but is not limited to motor vehicles, rail systems, marine applications, and small-engine and specialty equipment.

Sample occupations associated with this pathway:

- Service Technician/Maintenance Worker/Shop Foreman
- Technical Writer
- Dispatcher
- Engineer
- Investigator/Inspector

C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.

C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.

C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.

C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.

C5.0 Apply and understand appropriate business practices.

C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.

C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.

C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.

COMPETENCY-BASED COMPONENTS
for the Auto Tech: Electrical and Electronics/1 Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
A. ORIENTATION AND SAFETY Understand, apply and evaluate classroom and workplace policies and procedures used in accordance with federal, state and local safety and environmental regulations. (3 hours)	1. Describe the scope and purpose of the scope. 2. Describe the classroom policies and procedures. 3. Identify classroom and workplace first aid and emergency procedures. 4. Describe the different occupations in the Transportation Industry Sector which have an impact on the role of the auto technician. 5. Describe the California Occupational Safety and Health Administration (Cal/OSHA) workplace requirements for auto technicians. 6. Explain the impact of Environmental Protection Agency Resources Board (ARB) legislation on Transportation Industry Sector Practices in protecting and preserving the environment. 7. Explain the impact of California Air Resources Board (ARB) legislation on Transportation Industry Sector Practices in protecting and preserving the environment. 8. State the Bureau of Automotive Repair (BAR) standards for safety and environmental protection. 9. Describe and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the automotive industry. 10. Identify the safety items required by federal, state and local regulations. 11. Describe the role of the National Automotive Technicians Education Foundation (NATEF) in auto technician training. 12. Describe and demonstrate the NATEF standards regarding proper use of protective clothing and gloves in an auto shop. 13. Describe and demonstrate the NATEF standards regarding the proper use of protective respiratory gear in an auto shop. 14. Describe and demonstrate the NATEF standards regarding the proper use of protective eye gear in an auto shop. 15. Describe and demonstrate the NATEF standards regarding proper ventilation in an auto shop. 16. Describe and demonstrate NATEF standards regarding proper handling, storage and disposal of chemicals and materials used in an auto shop. 17. Pass the safety exam with 100% accuracy.	**Career Ready Practice:** 1, 2, 6, 12 **CTE Anchor:** Career Planning and Management: 3.4 Health and Safety: 6.1, 6.3, 6.5, 6.6, 6.7 Ethics and Legal Responsibilities: 8.2 Demonstration and Application: 11.2 **CTE Pathway:** C1.1, C1.2, C1.3, C1.4, C5.2

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
B. RESOURCE MANAGEMENT Understand, apply and evaluate the resource management principles and techniques in the auto repair and maintenance business. (1 Hour)	1. Define the following: a. resources b. management c. sustainability 2. Describe the management of the following resources in the auto shop repair and maintenance business: a. time b. materials c. personnel 3. List the specific examples of the effective management of the following in the auto repair and maintenance business: a. time b. materials c. personnel 4. Describe the benefits of the effective resource management in the auto repair and maintenance business: a. profitability b. sustainability c. company growth 5. Describe the economic benefits and liabilities of managing resources in an environmentally responsible way.	**Career Ready Practice:** 2, 3, 8 **CTE Anchor:** Responsibility and Flexibility: 7.1, 7.4, 7.6 **CTE Pathway:** C5.3
C. TRADE MATHEMATICS Understand, apply and evaluate the mathematical requirements used in the auto repair and maintenance.	1. Identify the practical of math in auto repair and maintenance. 2. Describe and demonstrate problem-solving techniques involving the whole number problems using addition, subtraction, multiplication and division. 3. Describe and demonstrate problem-solving techniques involving various decimal problems using arithmetic operations. 4. Describe and demonstrate problem-solving techniques involving various decimal problems, using arithmetic operations. 5. Describe and demonstrate techniques for changing fractions to decimals. 6. Describe and demonstrate techniques for changing decimals to fractions. 7. Describe the English system of measuring length. 8. Describe the English system of measuring weight. 9. Describe the English system of measuring volume or capacity. 10. Describe the relationships between various English linear units of measurement, such as inches, feet, yards and miles. 11. Describe the relationships between various English system units of volume or capacity, such as cups, pints, quarts and gallons. 12. Describe and demonstrate problem-solving techniques for various English system measuring problems, using arithmetic problems.	**Career Ready Practice:** 1, 2, 4, 5 **CTE Anchor:** Problem Solving and Critical Thinking: 5.2 **CTE Pathway:** C2.4, C2.7

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 Hours)	13. Describe and demonstrate measuring techniques of various objects by using the English system measuring tools common to the trade. 14. Describe the metric system of measuring length. 15. Describe the metric system of measuring weight. 16. Describe the metric system of measuring volume or capacity. 17. Describe the relationships between various metric system linear units of measurement such as millimeters, centimeters and meters. 18. Describe the relationships between various metric system units of weight such as milligrams, grams and kilograms. 19. Describe and demonstrate problem-solving techniques for various metric system measuring problems involving addition, subtraction, multiplication and division. 20. Describe and demonstrate measuring techniques of objects using metric system measuring tools common to the trade. 21. Describe and demonstrate problem-solving techniques for geometric problems that apply to auto repair and maintenance. 22. Describe and demonstrate problem-solving techniques for algebraic problems that apply to auto repair and maintenance. 23. Describe and demonstrate problem-solving techniques using percentages. 24. Describe and demonstrate techniques for reading and interpreting graphs. 25. Describe and demonstrate techniques for using calculator.	
D. TOOLS AND EQUIPMENT Understand, apply and evaluate the policies and procedures for using electrical and electronic repair and maintenance tools and equipment in accordance with federal, state and local safety and environment regulations. (10 Hours)	1. Identify and demonstrate the proper use, maintenance and storage techniques for the general shop hand tools. 2. Identify and demonstrate the proper use, maintenance and storage techniques for the general equipment. 3. Identify and demonstrate the proper use, maintenance and storage techniques for the following specialty tools and equipment for electrical and electronic repair and maintenance: a. connector pick tool set b. door panel trim tool(s) c. headlight aimer or screen d. heat gun (or equivalent for heat shrinking operations) e. wire and terminal repair kit	**Career Ready Practice:** 1 **CTE Anchor:** Health and Safety: 6.3 **CTE Pathway:** C2.2, C2.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
E. SERVICE MANUALS AND COMPUTER-BASED INFORMATION SYTEMS 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 CD-ROM (compact disc) and web-based search engines in finding automotive technical information. 5. Explain the advantages of using CD-ROM and web-based search engines over service manuals in finding automotive technical information.	**Career Ready Practice:** 1, 4 **CTE Anchor:** Communications: 2.3 Technology: 4.1, 4.2, 4.6 **CTE Pathway:** C2.6, C4.3
F. BASIC AUTOMOTIVE ELECTRICITY Understand, apply and evaluate the electrical principles and theories that are applicable to the auto repair and maintenance. (5 Hours)	1. Define the following: a. electricity b. current c. conductor d. resistance e. inductance f. voltage 2. Identify the devices used in measuring electrical activity. 3. Compare alternating current (AC) to direct current (DC). 4. Identify electrical circuits and their components. 5. Describe the operation of charging systems. 6. Describe how electricity can be generated. 7. List the electrical systems found in cars. 8. Describe the features and function of an automotive storage battery. 9. Test an automotive storage battery. 10. Describe the function of fuses. 11. List the different types of electrical accessories. 12. Describe the function of the different types of electrical accessories. 13. Test the charging system with proper testing equipment.	**Career Ready Practice:** 1, 2, 4 **CTE Anchor:** Communications: 2.6 Technology: 4.1 Problem Solving and Critical Thinking: 5.3, 5.4, Technical Knowledge and Skills: 10.1 **CTE Pathway:** C2.3, C2.5, C3.5, C7.1
G. GENERAL MOTORS ELECTRONIC FUEL AND IGNITION CONTROL Understand and evaluate the features if the General Motors electronic engine control systems.	1. Describe the features of the different types of General Motors electronic engine control systems. 2. Measure mixture control dwell. 3. Describe electronic spark timing sensor input. 4. State the features of the following General Motors electronic fuel injection systems: a. throttle body b. port c. digital fuel injection	**Career Ready Practice:** 2, 5 **CTE Anchor:** Problem Solving and Critical Thinking: 5.4

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 Hours)	5. Activate a General Motors self-diagnostic system 6. Measure different samples of General Motors sensor readings. 7. Identify the General Motors system trouble codes.	**CTE Pathway:** C2.3, C2.4, C2.5
H. FORD ELECTRONIC FUEL AND IGNITION CONTROL Understand and evaluate the following features of the Ford electronic engine control systems. (5 Hours)	1. Describe the features of the ford electronic engine and control systems: a. EEC I b. EEC II c. EEC III d. EEC IV 2. Measure mixture control dwell. 3. Describe the electronic spark timing sensor input. 4. Describe the features of the following Ford electronic fuel injection systems: a. single point b. multi point c. central d. sequential fuel injection 5. Activate a Ford self-diagnostic system. 6. Measure various Ford sensor readings. 7. Identify the Ford system trouble codes.	**Career Ready Practice:** 1, 4 **CTE Anchor:** Problem Solving and Critical Thinking: 5.4 Technical Knowledge and Skills: 10.1 **CTE Pathway:** C6.3, C6.4, C7.1
I. CHRYSLER ELECTRONIC FUEL AND IGNITION CONTROL Understand and evaluate the features of the Chrysler electronic engine control systems. (5 Hours)	1. Describe the features of the different types of Chrysler electronic engine control systems. 2. Measure and mixture control dwell. 3. Describe electronic spark timing sensor input. 4. Discuss the features of the Chrysler electronic fuel injection systems. 5. Activate a Chrysler self-diagnostic system. 6. Measure various Chrysler sensor readings. 7. Identify the Chrysler system trouble codes.	**Career Ready Practice:** 1, 4 **CTE Anchor:** Technical Knowledge and Skills: 10.4 **CTE Pathway:** C6.3
J. IMPORT ELECTRONIC FUEL AND IGNITION CONTROL Understand and evaluate the features of the electronic engine control systems in various imports.	1. Describe the features of the following import electronic engine control systems: a. Toyota TCCS b. Nissan ECCS c. Mitsubishi ECI 2. Describe the function of the electronic spark timing for the different types of the import systems. 3. Describe the features of the different types of import electronic fuel injection systems. 4. Describe the operation of the Continuous Injection Systems (CIS) and CIS-E injection systems. 5. Activate different types of import self-diagnosis systems.	**Career Ready Practice:** 1, 4 **CTE Anchor:** Problem Solving and Critical Thinking: 5.3, 5.4 **CTE Pathway:** C4.1, C5.6, C6.3

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(5 Hours)	6. Measure different samples of import sensor readings. 7. Identify the trouble codes found in the different types of imports.	
K. GENERAL ELECTRICAL SYSTEM DIAGNOSIS Understand, apply and evaluate the diagnostic techniques for an auto electrical system. (40 Hours)	1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause and correction. P-1 2. Identify and interpret electrical/electronic system concern; determine necessary action. P-1 3. Research applicable vehicle and service information, such as electrical/electronic system of operation, vehicle service history, service precautions, and technical service bulletins. P-1 4. Locate and interpret vehicle and major component identification numbers. P-1 5. Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law). P-1 6. Use wiring diagrams during diagnosis of electrical circuit problems. P-1 7. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including: source voltage, voltage drop, current flow and resistance. 8. Check the electrical circuits with a test light; determine necessary action. P-2 9. Check the electrical/electronic circuit waveforms; interpret readings and determine needed repairs. P-2 10. Check the electrical circuits using fused jumper wires; determine necessary action. P-2 11. Locate shorts, grounds, opens and resistance problems in electrical/electronic circuits; determine necessary action. P-1 12. Measure and diagnose the cause(s) of excessive parasitic draw; determine necessary action. P-1 13. Inspect and test fusible links, circuit breakers and fuses; determine necessary action. P-1 14. Inspect and test switches, connectors, relays, solenoid solid state devices and wires of electrical/electronic circuits; perform necessary action. P-1 15. Remove and replace terminal end from connector; replace connectors and terminal ends. P-1 16. Repair wiring harness (including CAN/BUS systems). P-1 17. Perform solder repair of electrical wiring. P-1 18. Identify location of hybrid vehicle high voltage circuit disconnect (service plug) location and safety procedures.	**Career Ready Practice:** 1, 4, 5, 11 **CTE Anchor:** Career Planning and Management: 3.3 Technology: 4.1 Problem Solving and Critical Thinking: 5.2, 5.4 **CTE Pathway:** C2.2, C2.3, C3.5, C7.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
L. BATTERY DIAGNOSIS AND SERVICE Understand, apply and evaluate the diagnostic and maintenance techniques for auto batteries. (30 Hours)	1. Perform battery state-of-charge test; determine necessary action. P-1 2. Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action. P-1 3. Maintain or restore electronic memory functions. P-1 4. Inspect, clean, fill and/or replace battery, battery cables, connectors, clamps and hold-downs. P-1 5. Perform battery charge. P-1 6. Start a vehicle using jumper cables or an auxiliary power supply. P-1 7. Identify high voltage circuits of electric or hybrid electric vehicle and related safety precautions. P-3 8. Identify electronic modules, security systems, radio and other accessories that require reinitialization or code entry following battery disconnect. P-1 9. Identify hybrid vehicle auxiliary (12v) battery service, repair and test procedures. P-3	**Career Ready Practice:** 1, 4, 5, 6 **CTE Anchor:** Problem Solving and Critical Thinking: 5.2, 5.3, 5.4 Health and Safety: 6.3, 6.6 Demonstration and Application: 11.1 **CTE Pathway:** C1.4, C2.2, C2.3, C7.1
M. STARTING SYSTEM DIAGNOSIS AND REPAIR Understand, apply and evaluate the diagnostic and repair techniques for auto starting system. (30 Hours)	1. Perform starter current draw test; determine necessary action. P-1 2. Perform starter circuit voltage drop tests; determine necessary action. P-1 3. Inspect and test starter relays and solenoids; determine necessary action. P-2 4. Remove and install starter in a vehicle. P-1 5. Inspect and test switches, connectors and wires of starter control units; perform necessary actions. P-2 6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition. P-2	**Career Ready Practice:** 1, 5 **CTE Anchor:** Problem Solving and Critical Thinking: 5.2, 5.4 Demonstration and Application: 11.1 **CTE Pathway:** C2.2, C2.3, C3.7, C7.7
N. CHARGING SYSTEM DIAGNOSIS AND REPAIR Understand, apply and evaluate the diagnostic and repair techniques for an auto charging system.	1. Perform charging system output test; determine necessary action. P-1 2. Diagnose charging system for the cause of undercharge, no-charge and overcharge conditions. P-1 3. Inspect, adjust or replace generator (alternator) drive belts, pulleys and tensioners; check pulley and belt alignment. P-1 4. Remove, inspect and install generator (alternator). P-1 5. Perform charging circuit voltage drop tests; determine necessary action. P-1	**Career Ready Practice:** 1, 5 **CTE Anchor:** Problem Solving and Critical Thinking: 5.2, 5.4 Demonstration and Application: 11.1

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(30 Hours)		**CTE Pathway:** C2.2, C2.3, C3.7, C7.7
O. EMPLOYABILITY SKILLS Understand, apply and evaluate the employability skills required in auto repair and maintenance. (4 Hours)	1. Summarize employer requirements for the following: a. punctuality b. attendance c. attitude toward work d. quality work e. teamwork f. responsibility g. timeless h. communication skills 2. Identify potential employers through traditional and internet sources. 3. Design sample resumes and cover letters. 4. Explain the importance of filling out a job application legibly, with accurate and complete information. 5. Describe common mistakes that are made on job applications. 6. Complete sample job application forms correctly. 7. Sate the importance of enthusiasm in the interview and on a job. 8. State the importance of appropriate appearance in the interview and on a job. 9. Sate the importance of the continuous upgrading job skills. 10. Describe customer service as a method of building permanent relationships between the organization and the customer.	**Career Ready Practice:** 1, 2, 4, 11 **CTE Anchor:** Communications: 2.1, 2.2, 2.3, 2.4 Career Planning and Management: 3.1, 3.2, 3.4, 3.9 Responsibility and Flexibility: 7.2, 7.4, 7.5, 7.7 Leadership and Teamwork: 9.2 Demonstration and Application: 11.5 **CTE Pathway:** C5.3, C5.4, C5.5

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Duffy, James E. Auto Electricity and Electronics. Goodheart-Wilcox Publisher, 2003.

Duffy, James E. Modern Automotive Technology, 7th Edition. Goodheart-Willcox Publishing, 2009.

Duffy, James E. and Nancy Henke-Konopasek. Auto Electricity and Electronics: Instructor's Guide, Goodheart-Wilcox Publisher, 2004.

Halderman, James D and Chase D. Mitchell. Diagnosis and Troubleshooting of Automotive Electric, Electronic, and Computer Systems, 4th Edition. Prentice Hall, 2006.

RESOURCES

Employer Advisory Board members

Foundation Standards
http://www.cde.ca.gov/ci/ct/sf/documents/transportation.pdf

Automotive Retailing Today (ART) 8400 Westpark Dr., MS 2, McLean, VA 22102. Phone: (703) 556-8578.

Automotive Youth Educational Systems (AYES) 50 W. Big Beaver, Suite 145, Troy, MI 48084. Phone: (248) 526-1750. Fax: (248) 526-1751.

National Automobile Dealers Association (NADA) Public Relations Dept., 8400 Westpark Dr., McLean, VA 22102-3591. Phone: (703) 821-7000.

National Automotive Technicians Education Foundation (NATEF) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6650. Fax: (703) 669-6125.
www.natef.org

http://www.ed-foundation.org/html_pages/products_programs_services/natef_tools/non-structural_analysis/non-structural_analysis.shtml

National Institute for Automotive Service Excellence (ASE) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6600.

SkillsUSA P.O. Box 3000, Leesburg, VA 20177-0300. Phone: (703) 777-8810. Fax: (703) 777-8999.
www. skillsusa.org

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

A. Lecture and discussion

B. Demonstration

C. Multimedia presentations

EVALUATION

SECTION A – Orientation and Safety – Pass the safety test with 100% accuracy.

SECTION B – Resource Management – Pass all assignments and exams on resource management with a minimum score of 80% or higher.

SECTION C – Trade Mathematics – Pass all assignments and exams on trade mathematics with a minimum score of 80% or higher.

SECTION D – Tools and Equipment – Pass all assignments and exams on tools and equipment with a minimum score of 80% or higher.

SECTION E – Service Manuals and Computer-Based Information Systems – Pass all assignments and exams on service manuals and computer-based information systems with a minimum score of 80% or higher.

SECTION F – Basic Automotive Electricity – Pass all assignments and exams on basic automotive electricity with a minimum score of 80% or higher.

SECTION G – General Motors Electronic Fuel and Ignition Control – Pass all assignments and exams on General Motors electronic fuel and ignition control with a minimum score of 80% or higher.

SECTION H – Ford Electronic Fuel and Ignition Control – Pass all assignments and exams on Ford electronic fuel and ignition control with a minimum score of 80% or higher.

SECTION I – Chrysler Electronic Fuel and Ignition Control – Pass all assignments and exams on Chrysler electronic fuel and ignition control with a minimum score of 80% or higher.

SECTION J – Import Electronic Fuel and Ignition Control – Pass all assignments and exams on import electronic fuel and ignition control with a minimum score of 80% or higher.

SECTION K – General Electrical System Diagnosis – Pass all assignments and exams on general electrical system diagnosis with a minimum score of 80% or higher.

SECTION L – Battery Diagnosis and Service – Pass all assignments and exams on battery diagnosis and service with a minimum score of 80% or higher.

SECTION M – Starting System Diagnosis and Repair – Pass all assignments and exams on starting system diagnosis and repair with a minimum score of 80% or higher.

SECTION N – Charging System Diagnosis and Repair – Pass all assignments and exams on charging system diagnosis and repair with a minimum score of 80% or higher.

SECTION O – Employability Skills – Pass all assignments and exams on employability skills with a minimum score of 80% or higher.

NATEF TASK PRIORITY ITEM TOTALS (by area)

I. Engine Repair

P-1 = 26 95% = 25 tasks
P-2 = 22 80% = 18 tasks
P-3 = 9 50% = 5 tasks

II. Automatic Transmission and Transaxle

P-1 = 21 95% = 20 tasks
P-2 = 17 80% = 14 tasks
P-3 = 4 50% = 2 tasks

III. Manual Drive Train and Axles

P-1 = 24 95% = 23 tasks
P-2 = 24 80% = 19 tasks
P-3 = 17 50% = 9 tasks

IV. Suspension and Steering

P-1 = 25 95% = 24 tasks
P-2 = 25 80% = 20 tasks
P-3 = 11 50% = 6 tasks

V. Brakes

P-1 = 39 95% = 37 tasks
P-2 = 10 80% = 8 tasks
P-3 = 11 50% = 6 tasks

VI. Electrical/Electronic Systems

P-1 = 39 95% = 37 tasks
P-2 = 13 80% = 10 tasks
P-3 = 10 50% = 5 tasks

VII. Heating and Air Conditioning

P-1 = 26 95% = 25 tasks
P-2 = 14 80% = 11 tasks
P-3 = 7 50% = 4 tasks

VIII. Engine Performance

P-1 = 39 95% = 37 tasks
P-2 = 12 80% = 10 tasks
P-3 = 7 50% = 4 tasks

DEFINITIONS OF TECHNICAL TERMS

ADJUST - to bring components to specified operational settings.

ALIGN - to restore the proper position of components.

ANALYZE - to assess the condition of a component or system.

ASSEMBLE (REASSEMBLE) - to fit together the components of a device or system.

BALANCE - to establish correct linear, rotational or weight relationship.

BLEED - to remove air from a closed system.

CAN – Controller Area Network. CAN is a network protocol (SAE J2284/ISO 15765-4) used to interconnect a network of electronic control modules

CHARGE - to bring to a specified state, e.g., battery or air conditioning system.

CHECK - to verify condition by performing an operational or comparative examination.

CLEAN - to rid component of foreign matter for the purpose of reconditioning, repairing, measuring or reassembling.

DEGLAZE – to remove a smooth glossy surface.

DETERMINE - to establish the procedure to be used to perform the necessary repair.

DETERMINE NECESSARY ACTION – indicates that the diagnostic routine(s) is the primary emphasis of a task. The student is required to perform the diagnostic steps and communicate the diagnostic outcomes and corrective actions required addressing the concern or problem. The training program determines the communication method (worksheet, test, verbal communication, or other means deemed appropriate) and whether the corrective procedures for these tasks are actually performed.

DIAGNOSE - to identify the cause of a problem.

DISASSEMBLE - to separate a component's parts as a preparation for cleaning, inspection or service.

DISCHARGE - to empty a storage device or system.

EVACUATE - to remove air, fluid or vapor from a closed system by use of a vacuum pump.

FLUSH - to internally clean a component or system.

HIGH VOLTAGE – voltages of 50 volts and higher.

HONE - to restore or resize a bore by using rotating cutting stones.

JUMP START - to use an auxiliary power supply to assist a battery to crank an engine.

LOCATE – to determine or establish a specific spot or area.

MEASURE - to determine existing dimensions/values for comparison to specifications.

NETWORK - a system of interconnected electrical modules or devices.

ON-BOARD DIAGNOSTICS (OBD) - diagnostic protocol which monitors computer inputs and outputs for failures.

PARASITIC DRAW - electrical loads which are still present when the ignition circuit is OFF.

PERFORM - to accomplish a procedure in accordance with established methods and standards.

PERFORM NECESSARY ACTION – indicates that the student is to perform the diagnostic routine(s) and perform the corrective action item. Where various scenarios (conditions or situations) are presented in a single task, at least one of the scenarios must be accomplished.

PURGE - to remove air or fluid from a closed system.

REMOVE - to disconnect and separate a component from a system.

REPAIR - to restore a malfunctioning component or system to operating condition.

REPLACE - to exchange a component; to reinstall a component.

RESURFACE – to restore correct finish.

SERVICE - to perform a procedure as specified in the owner's or service manual.

TEST - to verify condition through the use of meters, gauges or instruments.

TORQUE - to tighten a fastener to specified degree or tightness (in a given order or pattern if multiple fasteners are involved on a single component).

VERIFY - to confirm that a problem exists after hearing the customer's concern; or, to confirm the effectiveness of a repair.

VOLTAGE DROP - a reduction in voltage (electrical pressure) caused by the resistance in a component or circuit.

Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.