

Glendale Unified School District

Senior High School

June 21, 2016 (Revised)

Department: Career Technical Education (CTE)

Course Title: Introduction to Automotive Electrical Tools and Diagnostic Procedures  
106 A/B

Course Number:

Grade Level 9-12

Semester Credits: 10

Prerequisites: None

Textbook: Modern Automotive Technology 8th Edition by James Duffy

Course Description: This is an introductory course designed to provide the student with the fundamentals of the electrical systems of the modern motor vehicle. Students will learn how to safely perform basic vehicle electrical repair and maintenance operation and the proper use of automotive electrical tools and equipment. Emphasis will be placed on electrical fundamentals, symbols and circuit diagrams, batteries, starting, charging systems, ignition and lighting systems. Students will have the opportunity to perform minor repair work on school vehicles to complete required tasks. This course is designed to be a companion course to Auto 101 and Auto 103 and is one of the three prerequisite courses for Auto 107. Students are encouraged to complete all three courses in order to obtain a firm foundation in this subject, and is required for the General Technician Certificate program.

I. Standards

A. Career Technical Standards, Transportation - Pathway Standards: Systems Diagnostics Service and Repair

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

- a. C1.4: Use appropriate personal protective equipment and safety practices.
  2. C2.0: Practice the safe and appropriate use of tools, equipment and work processes.
  3. C3.0: Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
    - a. C3.1: Describe the operating principles of internal and/or external combustion engines.
  4. C4.0: Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.
    - a. C4.3: Use reference books, technical service bulletins, and other documents and materials related to the service industry available in print and through electronic retrieval systems to accurately diagnose and repair systems, equipment, and vehicles.
- B. Common Core Reading standards for literacy and Science and technical subjects (RST) grades 9-12
  1. RST 1: Cite specific textual evidence to support analysis of science and technical texts.
  2. RST 2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from a prior knowledge or opinions.
  3. RST3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.
  4. RST 4: Determine the meaning of symbols, key terms, and other domain specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-12 texts and topics.
  5. RST 6: Analyze the author's purpose and provide an explanation, describing a procedure, or discussing an experiment in a text.
  6. RST 7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.q., in a flowchart, diagram, model, graph, or table).

- C. Common Code Writing standards for literacy in History/Social Studies, Science and technical subjects (WHST) grades 9-12
  - 1. WHST 2: Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
  - 2. WHST 2d: Use precise language and domain specific vocabulary to inform about or explain the topic.

## II. Sample Assessments

- A. Quizzes and Tests
- B. Performance Tasks

## III. Topics of Study – Suggested Time Distribution

- A. Automotive Electrical Tools and Diagnostic procedure – Semester I
  - 1. Shop Safety 2 weeks
    - a. Upon successful completion of this session, the student in the Automotive Technology Program will understand the fundamentals of Automotive Shop Safety and be able to complete and pass the Auto Technology Department Safety Test. This is required to allow the students to perform hands on lab work. They will learn the use of Material Safety Data Sheets (MSDS) and understand hazardous material handling and OSHA standards.
  - 2. Automotive Careers and Opportunities 2.5 weeks
    - a. Upon successful completion of this session students will learn about the automotive industry opportunities and how to pursue them. This includes the writing of resumes, job search techniques, and industry careers. This also includes earning degrees in higher education. It will introduce the students into more than just auto mechanics, but an understanding of corporate or private management in the automotive field, including careers in sales, manufacturing, engineering and all facets of the industry.

3. Hand Tools and Power Tools 2.5 weeks
  - a. Upon successful completion of this session, students will be able to successfully demonstrate proper use of hand tools, power tools, and service equipment including floor jacks and hoists. They will be able to identify standard automotive hand tools as well as tools for specific tasks. They will work with both SAE standard and metric and be able to judge the quality of the tools, work clothes and personal apparel, including safety glasses, shoes, boots and gloves. The safe operation of power tools including drills, lathes and impact tools will also be covered, as well as the use of computers in the automotive shop.
  
4. Fundamentals of Electricity and Electronics 4 weeks
  - a. During this session students will be able to describe the basic parts of the atom, explain the principals of electricity, and understand the principles of magnetism and magnetic fields. They will be able to describe the action of electric circuits, compare voltage, current, and resistance, and compare DC and AC electricity as it applies to automotive vehicles. They will identify basic electric and electronic terms and components. The students will identify symbols and understand basic automotive schematics. They will do basic automotive maintenance and research applicable vehicle and service information.
  
5. Electrical Tools Test and Equipment 3 weeks
  - a. During this session students will be able to identify tools that are commonly used during electrical repairs. They will learn to select the proper electronic measuring device and tool for the job. They will demonstrate the proper use of a digital multi meter, check electrical circuits with a test light, measure source of voltage and perform voltage drop test in electrical circuit using a voltmeter. They will learn how to check continuity and measure resistance in an electrical circuit using an ohmmeter, and how to measure current flow in electrical circuit and components using ammeter.
  
6. Batteries Technology 3 weeks
  - a. During this session students will learn the basic operation of a battery cell and describe the basic parts of an automotive battery.

They will be able to summarize the function of all types of batteries, compare conventional and maintenance free batteries, and explain how temperature and other factors affect battery performance. They will learn the names of battery parts and the construction and function of an automotive battery, including the chemical composition of electrolyte. They will be able to describe the safety practices that should be followed when working with batteries and battery acid. Students will perform common battery tests and maintenance such as cleaning battery cases and terminals, charging a battery, the appropriate way to jump-start a car and replace a battery for the modern vehicle.

7. Final Review and Test 1 week
  
- B. Automotive Electrical Tools and Diagnostic procedure – Semester II
  1. Starting System 3.5 weeks
    - a. During this session students will be able to explain the principles of an electric motor, understand the construction and operation of a starting circuit, describe the function of the main starter drive parts, compare different type of starting motors, and explain the operation of solenoids. They will learn to interpret basic electronic diagrams and automotive schematics. Students will perform common starting system diagnosis, remove and replace a starting motor. They will understand the safety practices that should be followed when testing or repairing a starting system.
  
  2. Charging System Fundamental 3.5 weeks
    - a. During this session students will learn how the charging system reenergizes the battery and supplies electricity for all the car’s electrical systems, They will be able to describe major charging system components, explain charging system indicator light, compare alternator and voltage regulator design differences. They will understand the difference between alternating current and direct current. Students will inspect charging system, remove, test, repair, and replace an alternator, test and replace voltage regulator, adjust an alternator belt, and follow safety practices when testing or repairing a charging system.

3. Ignition System Fundamental 3 weeks
  - a. During this session students will be able to explain the operating principles of an automotive ignition system, compare contact points, electronic, and computer controlled ignition system, and describe the function of the major ignition system components. They will be able to identify primary and secondary sections of an ignition system and their electronic components. Student will diagnose basic ignition system problems using meters and basic tools. They will describe common tests used to find ignition system troubles, adjust ignition timing, replace and repair ignition system parts and minor tune-ups.
  
4. Operation and Service of lights and other vehicle accessories 3 weeks
  - a. During this session students will learn the operating principles of automotive lights, wipers, and horn systems. They will understand automatic light and wiper systems, and do basic maintenance like replacing burned-out bulbs. Students will be able to read electrical diagrams, explain analog and digital instrumentation, explain how to aim headlights, describe the safety practices to follow when working with light, wiper, and horn systems.
  
5. Computer System Fundamentals 3 weeks
  - a. During this session students will be able to identify major components of the computer system, describe the input signals, processing, and output sections of a basic computer system. They will be able to explain input sensor and output device classification and operation, summarize computer system signal classification, read electrical diagram for an automotive computer system. Students will be able to explain how a computer uses sensor inputs to determine correct outputs. Students will be able to discuss the purpose and operation of on-board diagnostic systems and explain the use of scan tools to simplify reading of trouble codes. They will be able to compare OBDI and OBDII system capabilities, locate the data link connector, activate on-board diagnostics, and read trouble code with and without a scan tool. They will research vehicle information from the onboard computer system by the use of manuals, technical publications, or other computer devices.
  
6. Heating and Air Conditioning Fundamentals 2 weeks

- a. During this session students will be able understand the principles of refrigeration, identify automotive A/C refrigerants, describe the four cycles of refrigeration, explain the basic function and construction of each major part of typical heating and air conditioning system, describe the safety practices to follow when working on heating and air conditioning systems.

7. Final Review and Test 1 week