



Electrical System Diagnosis

SYLLABUS

Your Course Learning Plan

A. General Course Information

Course description: The Electrical System Diagnosis students of UAW-LETC will successfully complete a series of activities that will meet the needs of Automotive Dealerships and the aftermarket while following guide lines of the National Automotive Training and Education Foundation (NATEF). These activities will consist of, but not limited to; properly using a voltmeter, ammeter, ohmmeter, and test light to obtain readings from electrical circuits on the Toyota Body Electrical Simulator and on bugged Toyota vehicles. Comprehensive system theory of operation will be taught on the following: Battery, Starting, Charging, Lighting, Warning, Wiper/Washer, Horn, Cruise Control, SRS, and BUS communication systems. Diagnostic strategies in locating electrical circuit faults will be presented. These activities will take place in the classroom and in the shop, consisting of written and hands-on exercises. Each phase will have its guidelines and time period. We will cover some areas with more detail than other's depending on the demand for that area.

Prerequisites: Technical Introduction to Dealerships: Module 12, Electrical Systems 1. (*Refer to TID Curriculum for more information*); and Electrical Fundamentals.

Organization: This is a lecture / classroom course in which topics are presented by the instructor, classroom assignments are explained and assigned projects are completed by students during class time. Objective quizzes are given daily and there is a comprehensive final exam. Electrical system Diagnosis is a prerequisite for air Conditioning, Engine controls, alignment, Toyota Transmission, Brake Technician (ABS), and Transmission diagnostics. Electrical system fundamentals are a prerequisite for this course. When students have completed this course they generally have the same level of expertise as those who have had previous training. Initial emphases are on the use of equipment and basic procedures.

Course objectives:

1. Demonstrate a working understanding of electrical wiring diagrams.
2. Exhibit the skill to diagnose starting, charging, and lighting systems etc.
3. Exhibit the skill to understand and follow diagnostic charts.
4. Exhibit the skill to diagnose and replace air bags.
5. Explain and demonstrate the strategy for locating shorts, opens, and high resistance in electrical circuits.
6. Demonstrate harness wire repair using wire cutters, strippers, soldering iron, solder, flux, and heat shrink tubing.
7. Demonstrate and explain proper procedure for testing diodes using a diode tester.

Textbooks / Software:

1. Toyota Electrical Circuit Diagnosis Course 623, Technician Handbook
2. Toyota Body Electrical Diagnosis Course 652, Technician Handbook
3. Video Library.

B. Course Content and Outcomes

- Course content:**
1. Review of Electrical Theory and Concepts
 2. Using the Electrical Wiring Diagram
 3. Tracing Current Flow in a System Circuit Diagram
 4. Digital Multimeters
 5. Using the Six-Step Diagnostic Process
 6. Diagnosing Open Circuit Problems
 7. Diagnosing Short Circuit Problems
 8. Diagnosing Parasitic Draws
 9. Diagnosing Feedback Problems
 10. Diagnosing High-Resistance Problems
 11. Batteries
 12. Starting System Diagnosis and Repair
 13. Charging System Diagnosis and Repair
 14. Lighting System Diagnosis and Repair
 15. Rear Window Defogger Diagnosis and Repair
 16. Gauges and Warning Light System Diagnosis and Repair
 17. Windshield Wiper/Washer System Diagnosis and Repair
 18. Motor Driven Accessory Diagnosis and Repair
 19. On-Vehicle Diagnostic Activities
 20. Introduction to Electronic Signals
 21. Supplemental Restraint Systems
 22. Cruise Control Systems
 23. Introduction to the Diagnostic Tester

- Learning outcomes:** Upon successful completion of this course the student will:
1. Demonstrate and practice personal responsibility skills required at the workplace.
 2. Practice interpersonal communication and problem solving skills.
 3. Utilize social and personal management skills.
 4. Demonstrate the skill to follow proper procedures in the measurement of voltage, amperage, and resistance in electrical circuits.
 5. Implement a diagnostic strategy that will aid in identification and location of faults in electrical circuits.
 6. Demonstrate the skill necessary to perform wire repair in line with the highest quality standards in the automotive industry.

Grading (credit) criteria: Course will be weighted as follows. Task Worksheets 40%, Quizzes 30%, homework assignments 10% and Final exam 20%.

Task worksheets are vital to the assessment of the student's performance competency. They will be assigned almost every day. Worksheets will be due at the end of each day. Grading will be based on a performance rating of "2" (Proficient) and "3" (Proficient, able to teach others) with a minimum rating of "2" being required for passing. (Extra credit will be given for a rating of "3").

There will be many objective quizzes given relating to current topics. Grading will be based on percentage of correctly answered questions. A grade of 80% is required for passing.

The final exam will be comprehensive relating to all topics covered in the course. Questions are written with heavy emphasis on critical thinking and diagnostic skills. A grade of 80% is required for passing.

C. Class/Shop Policies

- Student Expectations:**
1. Be on time for the start of class and return to class for final roll call.
 2. Appropriate working attire shall be worn.
 3. No jewelry will be worn while utilizing electrical simulators.
 4. Access to electrical simulators only as authorized by the instructor.

5. No cell phones or other electronic devices.
6. Participate in classroom discussions.
7. Observe classroom etiquette.
8. Participate in classroom clean up.
9. Attendance to classroom activities in assigned area.
10. Approval by instructor required prior to being absent from assigned area.
11. Ensure electrical simulators and multi-meters are off prior to storing them.
12. Follow all safety rules; be concerned with your safety and the safety of others

D. Other resources

Online resources: TechinfoToyota.com

Tentative Schedule

| DAY | TASK | TOPIC/ACTIVITY |
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| 1 | Toyota Worksheet 1-1M, Electrical Basics | <p>Review of Electrical Theory & Concepts</p> <p>Electrical Circuits Basic Electrical Terms Basic Diagnostic Tools Electrical Basics</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 1, Basic Electrical Concepts, pages 1-1 through 1-30</p> <p>Quiz: Electrical Basics</p> |
| 2 | Toyota Worksheet 2-1M, Switches and Relays Toyota Worksheet 2-2M, Using the EWD | <p>Using the Electrical Wiring Diagram (EWD)</p> <p>System Circuit Diagrams Understanding the System Circuit Diagram Support Sections Using the EWD in the Diagnostic Process</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 2, Using The Electrical Wiring Diagram, pages 2-1 through 2-27</p> |
| 3 | Toyota Worksheet 2-3M, Tracing Current Flow – Remote Control Mirror Toyota Worksheet 2-4M, Tracing Current Flow – Radiator Fan Circuit | <p>Tracing Current Flow In A System Circuit Diagram</p> <p>Available voltages to control devices Control device activation and circuit completion Load operation due to circuit completion and current flow</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 2, Using The Electrical Wiring Diagram, pages 2-28 through 2-30</p> |
| 4 | Toyota Worksheet 3-1M, Measuring Voltage Drop Toyota Worksheet 3-2M, Measuring Amperage | <p>Digital Multimeters (DVOM)</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 3, Using the Electronic Diagnostic Tools, pages 3-1 through 3-12</p> |

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| 5 | <p>Toyota Worksheet 4-1M, Practice Case Study "A" – Fault switch #9, Horn Does Not Work</p> <p>Fault Isolation Worksheet Normal, Horn</p> <p>Fault Isolation Worksheet A, Horn</p> <p>Fault Isolation Worksheet B, Horn</p> <p>Fault Isolation Worksheet C, Horn</p> | <p>Using the Six-Step Diagnostic Process</p> <p>Verify the Complaint</p> <p>Determine the Related Symptoms</p> <p>Analyze the Symptoms</p> <p>Isolate the Trouble</p> <p>Correct the Trouble</p> <p>Check for Proper Operation</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 4, Six-Step Troubleshooting Plan, pages 4-1 through 4-22</p> |
| 6 | <p>Toyota Worksheet 5-1M, Practice Case Study "B", Fault Switch #11, Interior Light Does Not Work</p> <p>Toyota Worksheet 5-2M, Practice Case Study "C", Fault Switch #16, Radio Does Not Work</p> <p>Toyota Worksheet 5-5M, Headlight Circuit - Switch #8</p> | <p>Diagnosing Open Circuit Problems</p> <p>Power source and ground point operation</p> <p>Checking available voltage systematically throughout a circuit</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 5, Diagnosing Body Electrical Problems, pages 5-1 through 5-3</p> |
| 7 | <p>Toyota Worksheet, 5-6M, Practice Case Study "D", Fault Switch #2, Gauges Do Not Work</p> <p>Toyota Worksheet, 5-7M, Gauge Fuse Circuit</p> <p>Toyota Worksheet, 5-9M, Short-to-Ground Diagnosis</p> <p>Toyota Worksheet 5-10M, Parasitic Load Diagnosis, Fault Switch #12</p> <p>Toyota Worksheet, 5-15M, Practice Case Study "F", Fault Switch #27, Turn Signals Do Not Work</p> | <p>Diagnosing Short Circuit Problems</p> <p>Diagnosing Parasitic Draws</p> <p>Diagnosing Feedback Problems</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 5, Diagnosing Body Electrical Problems, pages 5-7 through 5-22</p> |
| 8 | <p>Toyota Worksheet 5-11M, Practice Case Study "E" – Fault Switch #13, Interior Light Does Not Work</p> <p>Toyota Worksheet, 5-14M, Fault Switch #25, Taillight Dim</p> | <p>Diagnosing High-Resistance Problems</p> <p>Locating high resistance faults</p> <p>Checking circuit voltage drops</p> <p>Text: Toyota Course 652, Body Electrical Diagnosis, Technician Handbook, Section 5, Diagnosing Body Electrical Problems, pages 5-4 through 5-6, 5-18 through 5-21</p> |
| 9 | <p>Toyota Worksheet 623-3-1M, Battery Components</p> <p>Toyota Worksheet 623-3-2M, Battery Visual Inspection and Using the Battery Analyzer</p> | <p>Batteries</p> <p>Components</p> <p>Operation</p> <p>Diagnosis and Testing</p> <p>Text: Toyota Electrical Circuit Diagnosis, Course 623, Technician Handbook, Section 3, The Battery, pages 3-1 through 3-28</p> <p>Quiz: The Battery</p> |

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| <p>10-11</p> | <p>Toyota Worksheet 623-4-1M, Starting System Components Toyota Worksheet 623-4-2M, PS Starter Internal Components Toyota Worksheet 623-4-3M, Current Flow in the Starting System Toyota Worksheet 623-4-4M, Starting System Visual Inspection Toyota Worksheet 623-4-5M, Starter Current Draw Test Toyota Worksheet 623-4-6M, Starting System Voltage Drop Testing Toyota Worksheet 623-4-7M, Starter Relay Test Fault Isolation Worksheet Normal, Starting and Ignition Fault Isolation Worksheet A, Starting and Ignition Fault Isolation Worksheet B, Starting and Ignition Fault Isolation Worksheet C, Starting and Ignition Fault Isolation Worksheet D, Starting and Ignition Fault Isolation Worksheet E, Starting and Ignition Fault Isolation Worksheet F, Starting and Ignition Fault Isolation Worksheet G, Starting and Ignition Fault Isolation Worksheet H, Starting and Ignition</p> | <p>Starting System Diagnosis and Repair Components Operation Diagnosis and Testing</p> <p>Text: Toyota Electrical Circuit Diagnosis, Course 623, Technician Handbook, Section 4, The Starting System, pages 4-1 through 4-42</p> <p>Quiz: Starting Systems Quiz: Camry EWD Starting System</p> |
| <p>12-13</p> | <p>Toyota Worksheet 623-5-1M, Charging System Components Toyota Worksheet 623-5-2M, Charging System Visual Inspection Toyota Worksheet 623-5-3M, Alternator Output Tests Toyota Worksheet 623-5-4M, Charging System Voltage Drop Tests Fault Isolation Worksheet Normal, Charging Fault Isolation Worksheet A, Charging Fault Isolation Worksheet B, Charging Fault Isolation Worksheet C, Charging Fault Isolation Worksheet D, Charging Fault Isolation Worksheet E, Charging Fault Isolation Worksheet F, Charging Fault Isolation Worksheet G, Charging Fault Isolation Worksheet H, Charging</p> | <p>Charging System Diagnosis and Repair Components Operation Diagnosis and Testing</p> <p>Text: Toyota Electrical Circuit Diagnosis, Course 623, Technician Handbook, Section 5, The Charging System, pages 5-1 through 5-26</p> <p>Quiz: Charging Systems Quiz: Camry EWD Charging System</p> |

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| <p>17</p> | <p>Fault Isolation Worksheet Normal, Gauges Fault Isolation Worksheet A, Gauges Fault Isolation Worksheet B, Gauges Fault Isolation Worksheet C, Gauges Fault Isolation Worksheet D, Gauges Fault Isolation Worksheet E, Gauges Fault Isolation Worksheet F, Gauges Fault Isolation Worksheet Normal, Warning Lights Fault Isolation Worksheet A, Warning Lights Fault Isolation Worksheet B, Warning Lights Fault Isolation Worksheet C, Warning Lights Fault Isolation Worksheet D, Warning Lights Fault Isolation Worksheet E, Warning Lights Fault Isolation Worksheet F, Warning Lights Fault Isolation Worksheet G, Warning Lights</p> | <p>Gauges and Warning Light System Diagnosis and Repair</p> <p>Quiz: Gauges and Warning Devices</p> |
| <p>18</p> | <p>Fault Isolation Worksheet, Front Wiper and Washer Normal, Low Fault Isolation Worksheet, Front Wiper and Washer Normal, High Fault Isolation Worksheet, Front Wiper and Washer Normal, Wash Fault Isolation Worksheet A, Front Wiper and Washer Fault Isolation Worksheet B, Front Wiper and Washer Fault Isolation Worksheet C, Front Wiper and Washer Fault Isolation Worksheet D, Front Wiper and Washer Fault Isolation Worksheet E, Front Wiper and Washer Fault Isolation Worksheet F, Front Wiper and Washer Fault Isolation Worksheet G, Front Wiper and Washer</p> | <p>Windshield Wiper/Washer System Diagnosis and Repair</p> <p>Quiz: Wiper/Washer Systems Quiz: Camry EWD Wiper/Washer System</p> |

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| 19 | <p>Fault Isolation Worksheet, Normal Up, Power Window</p> <p>Fault Isolation Worksheet, Normal Down, Power Window</p> <p>Fault Isolation Worksheet A, Power Window</p> <p>Fault Isolation Worksheet B, Power Window</p> <p>Fault Isolation Worksheet C, Power Window</p> <p>Fault Isolation Worksheet D, Power Window</p> <p>Fault Isolation Worksheet E, Power Window</p> <p>Fault Isolation Worksheet F, Power Window</p> <p>Fault Isolation Worksheet G, Power Window</p> <p>Fault Isolation Worksheet H, Power Window</p> | <p>Motor Driven Accessory Diagnosis and Repair</p> <p>Radiator Fan and Condenser Fan</p> <p>Remote Control Mirror Circuit</p> <p>Power Window Circuit</p> <p>Power Seat Circuit</p> <p>Quiz: Motor Accessories</p> <p>Quiz: Camry EWD Power Window</p> |
| <p>20-A</p> <p>21-A</p> <p>22-A</p> <p>23-B</p> <p>24-B</p> <p>25-B</p> | <p>Worksheet ESD-S-2, Backup Light</p> <p>Worksheet ESD-S-8, Headlights</p> <p>Worksheet ESD-S-9, Horn</p> <p>Worksheet ESD-S-10, Dome Light</p> <p>Worksheet ESD-S-11, Dome Light</p> <p>Worksheet ESD-S-12, Battery Drain</p> <p>Worksheet ESD-S-13, Courtesy Light</p> <p>Worksheet ESD-S-14, Radiator Fan</p> <p>Worksheet ESD-S-15, Radiator Fan</p> <p>Worksheet ESD-S-16, Radio</p> <p>Worksheet ESD-S-17, RCM</p> <p>Worksheet ESD-S-18, RCM</p> <p>Worksheet ESD-S-19, Shift Lock</p> <p>Worksheet ESD-S-20, Shift Lock</p> <p>Worksheet ESD-S-25, Taillight</p> <p>Worksheet ESD-S-26, Taillight</p> <p>Worksheet ESD-S-27, Turn Signal</p> <p>Worksheet ESD-102-Tach-1</p> <p>Worksheet ESD-102-Start-1</p> <p>Worksheet ESD-102-Backup-1</p> <p>Worksheet ESD-103-Blower-1</p> <p>Worksheet ESD-103-Blower-2</p> <p>Worksheet ESD-104-Park-1</p> <p>Worksheet ESD-104-Lock-1</p> <p>Worksheet ESD-105-Window-1</p> <p>Worksheet ESD-105-Stop-1</p> <p>Worksheet ESD-106-Window-1</p> <p>Worksheet ESD-107-Fuel-1</p> <p>Worksheet ESD-107-Fuel-2</p> <p>Worksheet ESD-107-Turn-1</p> <p>Worksheet ESD-107-Turn-2</p> <p>Worksheet ESD-107-Turn-3</p> <p>Worksheet ESD-107-Window-1</p> | <p>On-Vehicle Diagnostic Activities</p> <p>Class breaks into two groups: Group A/Group B</p> <p>Days 20-22</p> <p>Group A – On-Vehicle Diagnostic Activities</p> <p>Group B – Classroom</p> <p>Days 23-25</p> <p>Group A – Classroom</p> <p>Group B – On-Vehicle Diagnostic Activities</p> |

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| | <p>Worksheet ESD-107-Lock-1 Worksheet ESD-107-Lighter-1 Worksheet ESD-108-Key-1 Worksheet ESD-108-Key-2 Worksheet ESD-108-Backup-1 Worksheet ESD-108-Wiper-1 Worksheet ESD-108-Washer-1 Worksheet ESD-108-Start-1 Worksheet ESD-108-Turn-1 Worksheet ESD-108-Turn-2 Worksheet ESD-109-Fog-1 Worksheet ESD-109-Start-1 Worksheet ESD-109-Turn-1 Worksheet ESD-109-Turn-2 Worksheet ESD-109-Oil-1 Worksheet ESD-109-Oil-2 Worksheet ESD-109-Lock-1</p> | |
| 20-B 23-A | <p>Toyota Worksheet 6-1, Analog and Digital Signals</p> | <p>Introduction to Electronic Signals Input and Output Signals Analog Signals Digital Signals Electronic Control Units (ECU's) Electronic Control Module (ECM) ECU Input ECU Data Processing ECU Output Signals Troubleshooting with an Oscilloscope</p> <p>Text: Toyota Electrical Circuit Diagnosis, Course 623, Technician Handbook, Section 6, Introduction to Electronic Signals, pages 6-1 through 6-14</p> <p>Quiz: Electronic Signals</p> |
| 21-B 24-A | <p>SRS Worksheet ESD-I-5A SRS Worksheet ESD-I-5B SRS Worksheet ESD-I-5C SRS Worksheet ESD-I-5D</p> | <p>Supplemental Restraint Systems (SRS)</p> <p>Quiz: Air Bags</p> |
| 22-B 25-A | <p>Cruise Control Worksheet ESD-I-4A Cruise Control Worksheet ESD-I-4B Cruise Control Worksheet ESD-I-4C Cruise Control Worksheet ESD-I-4D Cruise Control Worksheet ESD-I-4E</p> | <p>Cruise Control Systems</p> <p>Quiz: Cruise Control</p> |
| 26 | | <p>Toyota Course 652 Final Examination</p> <p>Post Test: Course 652 Electrical Circuit Diagnosis</p> |
| 27 | | <p>Course Review</p> <p>Quiz: Elec Sys Diag Pre-Final A Quiz: Elec Sys Diag Pre-Final B</p> |
| 28 | | <p>Course Final Examination</p> |

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| 29 | Toyota Worksheet 021-2-2M, Using the Toyota Diagnostic Tester | Introduction to the Diagnostic Tester Toyota Course 021, Technical Introduction to Toyota, Section 2, Toyota Technology, Toyota Diagnostic Tester, pages 121-128 |
| 30 | | End-of-Block TAR Day |