

# Automotive Technical Academy Training Manual

## Masters Course: General Automotive Electrical & Electronics

Duration: 3 Months (12 Weeks)

Mode: 30% Theory | 70% Practical

Level: Masters (Advanced, Industry-Ready Training)

### Course Goals

- Equip learners with advanced understanding of general automotive electrical & electronics systems.
- Build diagnostic, troubleshooting, and repair competence with modern tools.
- Develop mastery of wiring diagrams, control units, sensors, and actuators.
- Prepare graduates for professional certification and high-end workshop/industry practice.

### Course Structure

#### Month 1 – Foundations & Core Circuits

##### **Theory (30%)**

- Introduction to Automotive Electrical Systems (history, architecture, safety).
- Ohm's Law, power, resistance, voltage drop, and load analysis.
- Automotive wiring, connectors, fuses, relays, and switches.
- Electrical safety, standards, and use of service manuals/wiring diagrams.

##### **Practical (70%)**

- Hands-on: wiring harness identification, stripping, crimping, soldering, insulation.
- Circuit building: headlamps, horn, wipers, power windows, central locking.
- Use of multimeter, test lights, and oscilloscope.
- Fault simulation & diagnosis on lighting, charging, and starting systems.

#### Month 2 – Advanced Electronics & Control Systems

##### **Theory (30%)**

- Semiconductor basics (diodes, transistors, ICs) in automotive use.
- Alternators, starters, batteries: construction, control, smart charging.
- Introduction to sensors & actuators (thermistors, Hall-effect, MAP, MAF, TPS, O2 sensors).
- Control modules & communication (BCM, ECU, multiplexing, CAN bus basics).

##### **Practical (70%)**

- Testing alternators, batteries, and starters under load.
- Bench-testing sensors & actuators (signal waveform analysis).
- Building and troubleshooting relay-controlled circuits.
- Hands-on training with CAN bus simulators: reading signals, diagnosing comms failures.
- Faultfinding: charging failure, no-start conditions, erratic sensor outputs.

#### Month 3 – Diagnostics, Integration & Emerging Systems

##### **Theory (30%)**

- Advanced diagnostics and fault codes (OBD-II, manufacturer scan tools).
- Electronics integration: ABS, airbags, power steering, infotainment, HVAC.

- Hybrid & EV electrical architecture: high-voltage safety, battery management basics.
- Workshop management, documentation, customer communication, and industry standards.

### **Practical (70%)**

- Use of diagnostic scanners, oscilloscopes, and signal generators for real faults.
- Case studies: intermittent faults, CAN communication loss, parasitic drain tests.
- Practical module: installing & calibrating aftermarket accessories (alarms, sensors, trackers).
- EV/Hybrid hands-on exposure (if available): HV battery disconnects, inverter testing, motor control basics.
- Final project: Diagnose, document, and repair a complex multi-system fault on a live vehicle.

## **Assessment**

- Continuous Assessment: Practical lab reports (30%)
- Midterm Project: Fault diagnosis case study (20%)
- Final Project/Exam: Comprehensive system diagnosis & repair (50%)

## **Expected Outcomes**

By completion, participants will:

- Master automotive wiring, sensors, actuators, and ECU fundamentals.
- Confidently use multimeters, oscilloscopes, and OBD-II tools.
- Troubleshoot & repair faults in lighting, charging, starting, and communication systems.
- Understand integration with advanced systems (ABS, airbags, infotainment, EV basics).
- Be industry-ready for advanced diagnostic and electrical repair roles.