

Subscribers to Our Virtual Academy gain access to all the courses that are listed in this document. End Tests and Our Virtual Academy Certificates are included.

FUNDAMENTALS

Essential Electrical Skills

- Introduction to Electrics
- Voltage, Current and Resistance
- Types of Circuit
- The differences between DC and AC
- Facts about Voltage
- Fact One Explained
- Fact Two Explained
- Fact Three Explained
- Fact Four Explained
- Ohm's Law
- NTC Coolant Temperature Sensor Circuit
- Why Use Volt Drop?
- Relays
- Calculating Resistance of Series Circuits
- Current flow through Parallel Circuits
- Current flow and the unrestricted path
- Calculating identical Parallel Resistances
- Calculating differing Parallel Resistances
- Calculating differing Parallel Resistances continued
- Wiring Batteries into Circuits
- Watt's Law
- Essential Electrical Skills Course Test

Oscilloscopes

- Principles of Oscilloscope
- Advanced Oscilloscope- Triggers
- Advanced Oscilloscope- Rulers / Cursors

Measurement

- Vernier Caliper
- Micrometer
- DTI – Dial Test Indicator

Further Electrics

- Hall Effect
- The Piezoelectric Effect
- The Principles of MRE Sensors
- Transformers
- PWM
- The Principles of PTC

VEHICLE ELECTRICS

12V Batteries

- 12V Batteries and their Differences - Part 1
- 12V Batteries and their Differences - Part 2
- How Lead Acid Batteries Work – Part 1
- How Lead Acid Batteries Work – Part 2
- How Lead Acid Batteries Work – Part 3
- Battery Construction
- Battery Capacities
- State of Charge (SoC) - Part 1
- State of Charge (SoC) - Part 2
- Battery Diagnosis – Introduction
- Battery Diagnosis – Safety
- Battery Diagnosis – High-Rate Discharge Testing
- Battery Diagnosis – Carbon Pile Load Testing
- Battery Diagnosis – PicoScope Testing
- Battery Diagnosis – Conductance Testing
- Battery Charging – Rate of Charge
- Battery Charging – Connecting a charger
- Battery Charging – Off Vehicle Charging
- Battery Charging – Charging Voltage
- Battery Charging – Types of Chargers
- Battery Charging – Battery Support
- Jump Starting

Multiplexing

- MOST
- SENT

Power Management

- Power Management Introduction
- Ford Smart Charge - PWM Control
- Ford Smart Charge System Utilising LIN Bus Control
- Analogue Battery Sensors
- Intelligent Battery Sensors
- Load Shedding and System Deactivation
- Battery Regeneration
- Battery Registration
- Alternator Based Regenerative Braking
- Power Management Related Voltage Boosters

ENGINE MANAGEMENT

Sensors

- Engine Speed Sensor- Inductive Type
- Camshaft Position Sensor
- The Relationship Between Crankshaft and Camshaft Sensor Signal

Actuators

- The operation of a 6 pin Siemens VDO electronic throttle

Petrol Direct Fuel Injection Systems

- Introduction to Petrol Direct Injection Systems
- High Pressure Fuel Pump
- High Pressure Injectors- Piezo

ENGINE MANAGEMENT

Petrol Emissions

- Understanding Lambda
- Zirconium Dioxide Oxygen Sensor
- The Principles of Catalytic Converters
- 4 Gas Analysis – Introduction
- 4 Gas Analysis – Lambda
- 4 Gas Analysis – Air and Fuel
- 4 Gas Analysis – Perfect Combustion
- 4 Gas Analysis – True Combustion
- 4 Gas Analysis – The Role of the Catalytic Converter
- 4 Gas Analysis – Pre-checks
- 4 Gas Analysis – True Catalytic Converter Operation
- 4 Gas Analysis – Deviations from Lambda 1
- 4 Gas Analysis – Fuelling Maps
- 4 Gas Analysis – Fuel Trim – The Theory
- 4 Gas Analysis – Fuel Trim – The Realities
- 4 Gas Analysis – Fuel Trim – Indicators of Common Faults
- 4 Gas Analysis – Diagnosing using a Gas Analyser
- 4 Gas Analysis – Diagnostic Scenarios

Petrol Ignition Systems

- Fundamental Principles of an Ignition Coil
- Ignition Integrated Phase Detection
- Operating Principles of Wasted Spark Ignition Systems

The Essentials of Diesel Combustion

- Part 1 - Introduction to the Three Phases of Combustion
- Part 2 - The Generation and Retention of Heat
- Part 3 - Diesel Fuel and the Delay Period
- Part 4 - The Uncontrolled Burn and Diesel Knock
- Part 5 - NOx Production, EGR & The Controlled Burn
- Part 6 - Injection Timing

Diesel Components

- Introduction to IMV Common Rail Diesel – Part 1
- Introduction to IMV Common Rail Diesel – Part 2
- Diesel Particulate Filter (DPF) - The Chemistry of Combustion
- Diesel Particulate Filter (DPF) - Operation
- Diesel Particulate Filter (DPF) - Workshop Intervention

Diesel Diagnostics

- Leak-off Testing Solenoid Operated Diesel Injectors - Pt. 1
- Leak-off Testing Solenoid Operated Diesel Injectors - Pt. 2
- Testing Negative Low Pressure Supply Circuits – Pt. 1
- Testing Negative Low Pressure Supply Circuits – Pt. 2
- Diagnosing Inlet Metered High Pressure Diesel Pumps - Pt. 1
- Diagnosing Inlet Metered High Pressure Diesel Pumps - Pt. 2
- Diagnosing Inlet Metered High Pressure Diesel Pumps - Pt. 3
- Diagnosing Inlet Metered High Pressure Diesel Pumps - Pt. 4

ENGINE MECHANICAL

Pressure Measurement

- Relative Compression Testing

CHASSIS

ABS

- Calculating Slip Ratio
- ABS – Four Channel Four Sensor System

Tyres

- Tyre tread depth measurement
- Tyre Sidewall Marking - Introduction and Legislation
- Tyre Sidewall Marking - Tyre Dimensions
- Tyre Sidewall Marking - Speed and Load Ratings
- Tyre Sidewall Marking - Aging a Tyre
- Tyre Sidewall Marking - Extra Load Tyres
- Tyre Sidewall Marking - OE Tyres
- Tyre Sidewall Marking - Balancing Dots
- The Anatomy of a Tyre Tread
- Snow and Mud tyres
- Aquaplaning

Wheels

- Wheel Dimensions

HYBRID AND ELECTRIC VEHICLES

Introduction to hybrid

- What is hybrid?
- Hybrid Components
- Types of hybrids
- Micro and Mild Hybrids

Hybrid and Electric Vehicle Safety

- Health Conditions and Working on Hybrid and Electric Vehicles
- Ready Mode
- Electrocution
- ECE R100 Standard
- Measuring High Voltage Safely
- Isolating the High Voltage Components ('03 - '09 Toyota Prius NHW20) - Part 1 - The Components
- Isolating the High Voltage Components ('03 - '09 Toyota Prius NHW20) - Part 2 - The De-energising procedure
- Isolating the High Voltage Components ('03 - '09 Toyota Prius NHW20) - Part 3 - Confirming the System is Safe to Work on

Introduction to Electric Vehicles

- Introduction to Electric Vehicles – Part 1

Electric Vehicle Specific Safety

- Electric Vehicle Ready Mode
- Acoustic Vehicle Alerting System

HYBRID AND ELECTRIC VEHICLES

High Voltage Design Concepts and Safety Systems

- Introduction
- Equipotential Bonding
- Galvanic Isolation
- Isolation Monitoring – Prerequisite
- Isolation Monitoring – Introduction
- Isolation Monitoring – DC Balanced Bridge
- Isolation Monitoring – Capacitor Resistor Circuit – Film Capacitors
- Isolation Monitoring – Capacitors in Parallel and Series in DC Circuits
- Isolation Monitoring – Capacitors in AC Circuits
- Isolation Monitoring – The Capacitor Resistor Circuit
- Isolation Monitoring – Summary
- Interlock Circuits / Pilot Lines - Introduction
- Interlock Circuits / Pilot Lines - Toyota Prius NHW20
- Interlock Circuits / Pilot Lines – Tesla Model S
- Interlock Circuits / Pilot Lines – BMW 2013 i3
- Interlock Circuits / Pilot Lines – BMW 2013 i3 – Service Disconnect
- High Voltage Overcurrent protection - Introduction
- High Voltage Overcurrent protection - High Voltage Fuse
- High Voltage Overcurrent protection - Electronically Controlled Circuit Breaker
- High Voltage Overcurrent protection - Pyrotechnic Disconnect

Hybrid Components

- System Main Relays
- Hybrid Electric Motor Generators (Permanent Magnet Synchronous Motors) - Part 1
- Nickel Metal Hydride Batteries – Part 1 – Introduction
- Nickel Metal Hydride Batteries – Part 2 – Battery Monitoring
- Nickel Metal Hydride Batteries – Part 3 – Data Analysis
- Nickel Metal Hydride Batteries – Part 4 – Electrolyte Leakage
- Hybrid Braking Systems – Part 1
- Hybrid Braking Systems – Part 2
- Hybrid Braking Systems – Part 3

Hybrid Maintenance

- Dealing with a Hybrid in the Workshop
- Plug-in Hybrid and EV Charging – Safety
- Plug-in Hybrid and EV Charging – Modes
- Plug-in Hybrid and EV Charging – Plug Types
- Plug-in Hybrid and EV Charging – User Experience

Hydrogen Fuel Cell Vehicles

- An Introduction to Hydrogen Fuel Cell Vehicles

HVAC

The AC Refrigerant Cycle

- Part 1 - Introduction
- Part 2 – The Properties of Refrigerant
- Part 3 – Sensible Heat and Latent Heat
- Part 4 – The Effect of Pressure on Boiling Point
- Part 5 – The Cycle Explained

Components of the Air Conditioning System

- Fixed Swash Plate Air Conditioning Compressor
- The operation of Electromagnetic Clutches
- Variable Displacement Swash Plate Compressor Part 1
- Variable Displacement Swash Plate Compressor Part 2
- The Fixed Orifice Tube Air Conditioning System
- Controlling Air Conditioning Systems – Part 1
- Controlling Air Conditioning Systems – Part 2
- Controlling Air Conditioning Systems – Part 3

Servicing Air Conditioning Systems

- Performance Testing Air Conditioning Systems
- The Lubricants of Air Conditioning Systems
- Servicing A/C Systems – Part 1 Introduction
- Servicing A/C Systems – Part 2 Connecting the Machine
- Servicing A/C Systems – Part 3 Recovery
- Servicing A/C Systems – Part 4 Vacuuming Down the System
- Servicing A/C Systems – Part 5 Charging the System

Air Conditioning Safety

- Working Safely with Refrigerants

Legislation and Environmental Impact

- Legislation and Environmental Impact - Part 1
- Legislation and Environmental Impact - Part 2

Refrigerant Handling

- Introduction
- Safety
- Virgin Bottles
- Recovery Tanks
- Recovery Tanks Capacity Calculation
- Refrigerant Identification Techniques
- Transferring Refrigerant

Air Conditioning - Diagnostics

- Part 1 - Introduction
- Part 2 - Insufficient Cooling at the Condenser
- Part 3 - Low Compressor Efficiency
- Part 4 - Blockage in the Refrigerant Circuit
- Part 5 - Low Refrigerant
- Part 6 - Variable Displacement Compressor Faults
- Part 7 - Summary
- Leak Detection