Assessment Requirements

Unit AE06K – Knowledge of Diagnosis and Rectification of Vehicle Auxiliary Electrical Faults

Content:

The electrical principles that are related to light vehicle electrical circuits:

a. Ohms law
b. Voltage
c. Power
d. Current (AC and DC)
e. Resistance
f. Magnetism
g. Electromagnetism and electromagnetic induction
h. Digital and fibre optic principles
i. Electrical units and symbols
j. Electrical and electronic terminology
k. Relevant electrical safety

Battery and Charging

a. The construction and operation of vehicle batteries including:
    i. low maintenance and maintenance free
    ii. lead acid and nickel cadmium types
    iii. cells
    iv. separators
    v. plates
    vi. electrolyte
b. The operation of the vehicle charging system:
    i. alternator
    ii. rotor
    iii. stator
    iv. slip ring
    v. brush assembly
    vi. three phase output
    vii. diode rectification pack
    viii. voltage regulation
    ix. phased winding connections
    x. cooling fan
    xi. alternator drive system

Starting

a. The layout, construction and operation of engine starting systems: inertia and pre-engaged principles.
b. The function and operation of the following components:
    i. inertia and pre-engaged starter motor
    ii. starter ring gear
    iii. pinion
    iv. starter solenoid
    v. ignition/starter switch
    vi. starter relay (if appropriate)
    vii. one-way clutch (pre-engaged starter motor)

Lighting systems and technology

a. Lighting systems should include:
   i. Xenon lighting
   ii. gas discharge lighting
   iii. ballast system
   iv. LED
   v. intelligent front lighting
   vi. blue lights
   vii. complex reflectors
   viii. fibre optic
   ix. optical patterning

Lighting circuits and the relationship between each circuit

a. Circuits must include:
   i. Sidelights including number plate lights and marker lights
   ii. dipped beam
   iii. main beam
   iv. dim/dip
   v. indicators and hazard lights
   vi. high intensity and fog light

Common faults and testing methods associated with external lighting system

a. Fault diagnosis for:
   i. lighting systems failing to operate correctly
   ii. switches
   iii. relays
   iv. bulbs failing to operate

The operating principles of external lighting systems and multiplexing systems

a. To include all external lighting systems and a good knowledge of multiplexing systems.

The different types of electric windows, and mirror systems and components

a. Components should include:
   i. window
   ii. mirror motors
   iii. multi-functional switches
   iv. relays
   v. total closure modules

The function of component parts in the electric window and mirror systems

a. Components must include:
   i. motors
   ii. relays
   iii. interfaces
   iv. modules
   v. switches

The operating principles of electric windows and mirror systems

a. Operating principles of the following:
   i. motors
   ii. interfaces
   iii. switches
   iv. modules
   v.

Common faults and testing methods associated with electric windows mirror systems

a. Fault diagnosis for:
   i. electric windows failing to open or close
   ii. electric mirrors fail to adjust
   iii. slow operation on both systems

The different types of screen heating systems and components

a. Systems must include:
   i. heated front screens
   ii. heated rear screens
   iii. heated mirrors

The function and operating principles of components for heated screen and mirror systems

a. Components must include:
   i. front screen elements
   ii. mirror elements
   iii. time control relays
   iv. multifunction relays and switches

Common faults and testing methods associated with heated screen and mirror systems

a. Faults must include:
   i. screen elements not operating
   ii. timer relays not operating and staying on permanently

The different types of In Car Entertainment (ICE) systems and components

a. Systems and components must include:
   i. radio CD and multi play units
   ii. DVD players
   iii. MP3 players
   iv. speakers
   v. aerial systems
   vi. amplifiers
   vii. V.D.U. screens
   viii. Satellite Navigation
   ix. communication units

The function of components in ICE systems

a. Systems include:
   i. radios
   ii. CD players
   iii. video players
   iv. DVD players
   v. aerial systems
   vi. speakers
   vii. amplifiers
   viii. VDU screens
   ix. mobile communication units

The operating principles of ICE systems

a. Operation of entertainment systems speaker and aerial systems

Common faults and testing methods associated with ICE systems

a. Faults to include:
   i. entertainment and navigation units not operating
   ii. speaker, aerial and amplifier systems not functioning correctly

iii. excessive radio interference (suppression)
iv. use of diagnostic computers and systems

The different types of integrated security/warning systems and components

a. Components to include:
   i. control units
   ii. alarm modules
   iii. audible warning units
   iv. immobiliser units
   v. sensing units
   vi. horn
   vii. audible warning speakers

The function of component parts in integrated security and warning systems

a. Components to include
   i. control units
   ii. alarm modules
   iii. audible warning units
   iv. interior sensing systems
   v. immobiliser units
   vi. relays
   vii. LED's
   viii. horns

The operating principles of integrated security and warning systems

a. Operation of alarm systems and audible warning units.

The relevant legislation relevant to security and warning systems

a. Find and apply all relevant legislation for the fitment and use of security and warning systems.

Common faults and testing methods associated with security and warning systems

a. Components to include:
   i. control units
   ii. audible warning units
   iii. immobiliser units
   iv. horns
   v. relays
   vi. LED's
   vii. wiring
   viii. connections and protection devices
   ix. removal and refitting procedures
   x. using computer diagnostics to identify faults
   xi. use of manufacturers diagnostic equipment

The different wiper system components

a. Components must include:
   i. wiper motors
   ii. washer motors
   iii. wiper linkage
   iv. multifunction relays
   v. headlamp wash/wipe

The function of component wiper and washer components

a. Components and systems must include:

i. wiper motors
ii. intermittent wash wipe relays
iii. parking systems

The operating principles, faults and testing methods of wiper and washer systems

a. Principles, fault diagnosis and testing for:

i. wiper motors failing
ii. damaged linkages
iii. incorrect operation of intermittent and parking systems
iv. earth faults
v. control unit failure

The different heater, cooling system components and air con.

a. Components include:

i. heater motors
ii. speed rheostats,
iii. switches
iv. valves
v. radiator cooling fan motors
vi. relays
vii. air conditioning units

The function of component heater, cooling parts and air conditioning

a. Components include:

i. heater motors
ii. rheostats
iii. valves
iv. switches
v. relays
vi. cooling fan motors
vii. air conditioning units
viii. thermostatic switches

The operating principles of heater, cooling systems and air conditioning

a. Principles to include:

i. conduction
ii. convection
iii. radiation
iv. circulation
v. boiling points
vi. states of matter (Gas, liquid, solid)
vii. temperature control
viii. antifreeze mixtures
ix. heat transfer

Common faults and testing methods associated with heater, cooling systems and air conditioning

a. Fault diagnosis for:

i. heater motor failing to operate on all/one speed
ii. radiator cooling fan not operating
iii. valves
iv. relays
v. switches not operating

vi. electrical related faults on the air conditioning system

The different types of locking system components

a. Door locking actuators, solenoids, deadlocking actuators, anti-theft modules.

The function of component parts in the locking system

a. Solenoids, actuators (electrical and pneumatic), multifunctional relays, anti-theft modules and release systems.

The operating principles of locking systems

a. Doors and cabs

Common faults and testing methods associated with locking systems

a. Door locking actuators, solenoids, connections, wiring, relays, and protection devices/fuses

The different types of Supplementary Restraint and Airbag systems

a. Components include:
   i. control units
   ii. sensors
   iii. seat belt pretensioners
   iv. airbag assemblies
   v. wiring systems
   vi. warning systems

The function of component parts in the Supplementary Restraint and Airbag systems

a. Components include:
   i. control units
   ii. interfaces
   iii. sensors
   iv. airbag units
   v. pretensioners

The operating principles of Supplementary Restraint and Airbag systems

a. Operation of the sensors.
b. Operation of the airbag unit.
c. Operation of the various types of pretension.
d. Safe handling procedures and regulations.

Common faults and testing methods associated Supplementary Restraint and Airbag systems

a. Fault diagnosis for Airbag and SRS faults:
   i. fault code identification
   ii. wiring faults
   iii. component failure
   iv. earth problems
   v. sensor faults.

How to examine, measure and make suitable adjustments to components are:

a. Settings
b. Input and output values
c. Voltages
d. Current consumption
e. Resistance
f. Input and output patterns with oscilloscope (including frequency and duty cycle measurements)
g. Condition

h. Wear and performance

How to select, prepare and use diagnostic and rectification equipment for automotive auxiliary electrical systems:

a. Voltmeters
b. Ammeters
c. Ohmmeters
d. Multi-meters
e. Battery testing equipment
f. Dedicated and computer based diagnostic equipment
g. Oscilloscopes