Auto-Electrical & Mobile Electrical Installation
(Syllabus Content)

Assessment Requirements

Unit G01/02K – Knowledge of Health, Safety and Good Housekeeping in the Automotive Environment

Content:

Economic use of Resources

a. consumable materials e.g. grease, oils, split pins, locking and fastening devices etc.

Requirement to maintain work area effectively

a. cleaning tools and equipment to maximise workplace efficiency.
b. requirement to carry out the housekeeping activities safely and in a way that minimises inconvenience to customers and staff.
c. risks involved when using solvents and detergents.
d. advantages of good housekeeping.

Spillages, leaks and waste materials

a. relevance of safe systems of work to the storage and disposal of waste materials.
b. requirement to store and dispose of waste, used materials and debris correctly.
c. safe disposal of special / hazardous waste materials.
d. advantages of recycling waste materials.
e. dealing with spillages and leaks

Basic legislative requirements

a. Provision and Use of Work Equipment Regulations 1992.
b. Power Presses Regulations 1992.
c. Pressure Systems and Transportable Gas Containers Regulations 1989.
d. Electricity at Work Regulations 1989.
e. Noise at Work Regulations 1989.
f. Manual Handling Operations Regulations 1992.
g. Health and Safety (Display Screen Equipment) Regulations 1992.
h. Abrasive Wheel Regulations.
i. Safe Working Loads.
j. Working at Height Regulations (date)

Routine maintenance of the workplace

a. Trainees personal responsibilities and limits of their authority with regard to work equipment.
b. Risk assessment of the workplace activities and work equipment.
c. Workplace person responsible for training and maintenance of workplace equipment.
d. When and why safety equipment must be used.
e. Location of safety equipment.
f. Particular hazards associated with their work area and equipment.
g. Prohibited areas.
h. Plant and machinery that trainees must **not** use or operate.
i. Why and how faults on unsafe equipment should be reported.
j. Storing tools, equipment and products safely and appropriately.
k. Using the correct PPE.
l. Following manufacturers' recommendations.

m. Location of routine maintenance information e.g. electrical safety check log.

Legislation relevant to Health and Safety

i. HASAWA
ii. COSHH
iii. EPA
iv. Manual Handling Operations Regulations 1992
v. PPE Regulations 1992

General regulations to include an awareness of:

i. Health and Safety (Display Screen Equipment) Regulations 1992
ii. Health and Safety (First Aid) Regulations 1981
iii. Health and Safety (Safety Signs and Signals) Regulations 1996
iv. Health and Safety (Consultation with Employees) Regulations 1996
v. Employers Liability (Compulsory Insurance) Act 1969 and Regulations 1998
vi. Confined Spaces Regulations 1997
vii. Noise at Work Regulations 1989
viii. Electricity at Work Regulations 1989
ix. Electricity (Safety) Regulations 1994
x. Fire Precautions Act 1971
xi. Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1985
xii. Pressure Systems Safety Regulations 2000
xiii. Waste Management 1991
xiv. Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) 2002
xv. Control of Asbestos at Work Regulations 2002

Legislative duties

a. The purpose of a Health and Safety Policy.
b. The relevance of the Health and Safety Executive.
c. The relevance of an initial induction to Health and Safety requirements at your workplace.
d. General employee responsibilities under the HASAWA and the consequences of non-compliance.
e. General employer responsibilities under the HASAWA and the consequences of non-compliance.
f. The limits of authority with regard to Health and Safety within a personal job role.
g. Workplace procedure to be followed to report Health and Safety matters.

Precautions to be taken when working with vehicles, workshop materials, tools and equipment including electrical safety, pneumatics and hydraulics

a. Accessing and interpreting safety information
b. Seeking advice when needed
c. Seeking assistance when required
d. Reporting of unsafe equipment
e. Storing tools, equipment and products safely and appropriately
f. Using the correct PPE
g. Following manufacturers recommendations
h. Following application procedures e.g. hazardous substances
i. The correct selection and use of extraction equipment

PPE to include:

a. Typical maintenance procedures for PPE equipment to include:

i. typical maintenance log
ii. cleaning procedures
iii. filter maintenance
iv. variation in glove types

v. air quality checks

b Choice and fitting procedures for masks and air breathing equipment.

c. Typical workplace processes which would require the use of PPE to include:

i. welding
ii. sanding and grinding
iii. filling
iv. panel removal and replacement
v. drilling
vi. cutting
vii. chiselling
viii. removal of broken glass
ix. removal of rubber seals from fire damaged vehicles
x. removal of hypodermic needles
xi. servicing activities
xii. roadside recovery

d. Unserviceable PPE.

e. PPE required for a range automotive repair activities. To include appropriate protection of:

i. eyes
ii. ears
iii. head
iv. skin
v. feet
vi. hands
vii. lungs

Fire and extinguishers

a. Classification of fire types
b. Using a fire extinguisher effectively.

Types of Extinguishers

a. foam
b. dry powder
c. CO2
d. water
e. fire blanket

Action to be taken in the event of a fire to include:

a. The procedure as:

i. raise the alarm
ii. fight fire only if appropriate
iii. evacuate building
iv. call for assistance

Product warning labels to include:

a. Reasons for placing warning labels on containers.
b. Warning labels in common use, to include:

i. toxic
ii. corrosive
iii. poisonous
iv. harmful
v. irritant
vi. flammable
vii. explosive

Warning signs and notices

a. Colours used for warning signs:

i. red
ii. blue
iii. green

b Shapes and meaning of warning signs:
i. round
ii. triangular
iii. square

c. The meaning of prohibitive warning signs in common use.
d. The meaning of mandatory warning signs in common use.
e. The meaning of warning notices in common use.
f. General design of safe place warning signs.

Hazards and risks to include:

a. The difference between a risk and a hazard.
b. Potential risks resulting from:
i. the use and maintenance of machinery or equipment
ii. the use of materials or substances
iii. accidental breakages and spillages
iv. unsafe behaviour
v. working practices that do not conform to laid down policies
vi. environmental factors
vii. personal presentation
viii. unauthorised personal, customers, contractors etc entering your work premises
ix. working by the roadside
x. vehicle recovery
c. The employee's responsibilities in identifying and reporting risks within their working environment.
d. The method of reporting risks that are outside your limits of authority.
e. Potential causes of:

i. fire
ii. explosion
iii. noise
iv. harmful fumes
v. slips
vi. trips
vii falling objects
viii accidents whilst dealing with broken down vehicles

Personal responsibilities

a. The purpose of workplace policies and procedures on:
i. the use of safe working methods and equipment
ii. the safe use of hazardous substances
iii. smoking, eating , drinking and drugs
iv. emergency procedures
v. personal appearance
b. The importance of personal appearance in the control of health and safety.

Action to be taken in the event of colleagues suffering accidents

a. The typical sequence of events following the discovery of an accident such as:
i. make the area safe
ii. remove hazards if appropriate i.e. switch off power
iii. administer minor first aid
iv. take appropriate action to re-assure the injured party
v. raise the alarm

vi. get help
vii. report on the accident

b Typical examples of first aid which can be administered by persons at the scene of an accident:

i. check for consciousness
ii. stem bleeding
iii. keep the injured person's airways free
iv. place in the recovery position if injured person is unconscious
v. issue plasters for minor cuts
vi. action to prevent shock i.e. keep the injured party warm
vii. administer water for minor burns or chemical injuries
viii. wash eyes with water to remove dust or ingress of chemicals (battery acid)
ix. need to seek professional help for serious injuries

c Examples of bad practice which may result in further injury such as:

i. moving the injured party
ii. removing foreign objects from wounds or eyes
iii. inducing vomiting
iv. straightening deformed limbs

Assessment Requirements

Unit G3K – Knowledge of Support for Job Roles in the Automotive Environment

Content:

The structure of a typical vehicle repair business

a. How these areas relate to each other within the business

i. body shop
ii. vehicle repair workshop
iii. paint shop
iv. valeting
v. vehicle parts store
vi. main office
vii. vehicle sales
viii reception

b. Sources of information

a. other staff
b. manuals
c. parts lists
d. computer software and the internet
d. manufacturer
e. diagnostic equipment

Communication requirements when carrying out vehicle repairs

a. Locating and using correct documentation and information for:

i. recording vehicle maintenance and repairs
ii. vehicle specifications
iii. component specifications
iv. oil and fluid specifications
v. equipment and tools
vi. identification codes

b. Procedures for:

i. referral of problems
ii. reporting delays
iii. additional work identified during repair or maintenance
iv. keeping others informed of progress

Methods of Communication

a. verbal
b. signs and notices

c. memos
d. telephone
e. electronic mail
f. vehicle job card
g. notice boards
h. SMS text messaging
i. Letters

a. Organisational & Customer requirements:

i. importance of time scales to customer and organization
ii. relationship between time and costs
iii. meaning of profit

b. Choice of Communication

a. distance
b. location
c. job responsibility

b. Importance of maintaining positive working relationships:
a. morale
b. productivity
c. company image
d. customer relationships
e. colleagues

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Assessment Requirements

Unit G4K – Knowledge of Materials, Fabrication, Tools and Measuring Devices used in the Automotive Environment

Content:

Common types of hand tools used for fabricating and fitting in the automotive workplace. To include:

a. files
b. hacksaws and snips
c. hammers
d. screwdrivers
e. pliers
f. spanners
g. sockets
h. punches
i. types of drill and drill bits
j. taps and dies
k. stud removers
l. marking out tools

Common measuring devices used for fabrication and fitting in the automotive workplace. To include:

a. rule/tape
b. callipers
c. feeler gauge
d. volume measures
e. micrometer
f. dial gauges
g. torque wrenches
h. depth gauges

Common electrical measuring tools used in the repair of vehicles and components. To include:

a. ammeter
b. voltmeter
c. ohmmeter
d. multi-meter

Common electrical terms when measuring:

a. voltage
b. current
c. resistance

Workshop equipment (including appropriate PPE). To include:

a. hydraulic jacks
b. axle stands
c. pillar drills
d. air tools
e. vehicle lifts
f. cranes

g. hoists
h. electrical power tools

Properties, application and limitations (to include safe use) of ferrous and non-ferrous metals used when constructing, modifying and repairing vehicles and components. Materials to include:

a. carbon steels
b. alloy steels
c. cast iron
d. aluminium alloys
e. brass
f. copper
g. lead

Properties, application and limitations (to include safe use) of non-metallic materials used when constructing, modifying and repairing vehicles and components. Materials to include:

a. glass
b. plastics (inc. GRP)
c. Kevlar
d. rubber

Terms relating to the properties of materials. To include:

a. hardness
b. toughness
c. ductility
d. elasticity
e. tenacity
f. malleability
g. plasticity

Assessment Requirements

Unit G6K – Knowledge of how to Make Learning Possible through Demonstrations and Instruction

Content:

Separate areas of demonstration which encourage learning. To include:

a. demonstration is particularly applicable to learning manual skills.
b. learning to do something usually involves:
    i. purpose – the aim or objective
    ii. procedure - the most effective way of completing the task
    iii. practice – all skills require practice to improve
c. practical tasks are more quickly learnt through demonstration.
d. emphasis is required to body movements when demonstrating.
e. the demonstrator should encourage learners to ask questions.
f. emphasis should be placed upon key points whilst demonstrating.
g. any demonstration should ensure that all safety aspects are covered.

Types of learning which are best achieved and supported through demonstrations. **To include:**

a. types of learning:
    i. psychomotor – measurement of manual skill performance
    ii. cognitive – learning involving thought processes
    iii. affective – demonstration of feelings, emotions or attitudes
b. demonstration - involves learning to do something (Psychomotor Domain).
c. combination of instruction and practical demonstrations are very effective means of learning practical skills.

How to structure demonstration and instruction sessions. To include:

a. Before the demonstration and/or instruction ensure that the following good practice is recognised:
    i. identify key points
    ii. relate theoretical underpinning knowledge to key points
    iii. rehearse to ensure that all equipment is working
    iv. ensure all students can see even small equipment and processes
    v. time the demonstration
    vi. consider how to make students participate
    vii. consider how to emphasise safe working practices
b. During the demonstration and/or instruction good practice is to:
    i. give a clear introduction
    ii. identify any tools/equipment
    iii. determine the current audience level of knowledge
    iv. complete the demonstration correctly (do not show how not to do it)
    v. stress key points and show links between them
    vi. monitor safety aspects
    vii. check learner understanding
c. After the demonstration(if possible)
    i. enable the audience to practice the techniques
    ii. provide feedback on their performance

How to identify individual learning needs

a. Diagnose the learning needs of your audience to include:

i. what competencies they already have
ii. what experience they have of the subject area
iii. what competencies they need to achieve
iv. what demonstration techniques are best suited to their needs
iv. how you will assess their needs have been met

What factors are likely to prevent learning. To include:

i. language barriers
ii. physical barriers
iii. specialist knowledge
iv. pace of learning
v. method of delivery
vi. environmental factors
vii. teaching styles
viii. dyslexia

How to check learners understanding and progress

a. Questionnaires.
b. Verbal questioning.
c. Observation.
d. Assessment.
e. Role play.
f. Projects/assignments.
g. Multi-choice questions.
h. Simulation.
i. Tests.

How to organise information and prepare materials

a. Identify the course aim.
b. Identify the subject aim.
c. Identify the lesson aim.
d. Complete a lesson plan - plan the teaching.
e. Identify a series of 'cues' to be used during the lesson.
f. Logically organise the information.
g. Use suitable resources and equipment to maximise learning opportunities.
h. Assess the learners progress and understanding.

Instructional techniques

a. types of instructional techniques to include:
   i. lectures
   ii. handouts
   iii. team teaching
   iv. peer teaching
   v. discussion – individual, group and peer
   vi. question and answer
   vii. multimedia
   viii. seminars
   ix. case studies
   x. project/assignments

Environmental factors that effect learning

a. environmental factors that should be considered before demonstration/instruction to include:
   i. loud noises
   ii. bright colours
   iii. bright lights

iv. strong smells
v. atmosphere
vi. temperature
vii. classroom seating
viii. classroom layout
ix. bright lights

Health and safety factors that affect learning

a. health and safety factors that should be considered before demonstration/instruction to include:
   i. assessment of risk and hazards
   ii. condition of electrical/electronic equipment
   iii. position of cables and wires
   iv. safety of equipment used in demonstration/instruction
   v. condition of classroom equipment/furniture/structure
   vi. suitable protective clothing/equipment

Analysis of demonstration/instruction

a. Analysis of demonstration/instruction to include:
   i. feedback from students
   ii. feedback from colleagues
   iii. organisational quality assessment
   iv. feedback from external organisations
   v. awarding body requirements

Developments in learning. To include:

i. multimedia based materials
ii. web based materials
iii. interactive materials

How to choose and prepare appropriate materials. To include:

a. putting information in order
b. deciding whether the language used is appropriate
c. type of material i.e. paper and technology based etc.

Assessment Requirements

Unit G8K – Knowledge of how to Identify and Agree Customer Service Needs

Content:

Organisational Requirements

a. Explain the organisation's terms and conditions applicable to the acceptance of customer vehicles.
b. Explain the content and limitations of vehicle and component warranties for the vehicles dealt with by your organisation.
c. Detail what, if any, limits there are to the authority for accepting vehicles.
d. Detail why it is important to keep customers advised of progress and how this is achieved within the organisation.
e. Detail the organisation's procedures for the completion and processing of documentation and records, including payment methods and obtaining customer signatures as applicable.

Principles of Customer Communication and Care.

a. First Impressions.
b. Listening skills – 80:20 ratio.
c. Eye contact and smiling.
d. Showing interest and concern.
e. Questioning techniques and customer qualification.
f. Giving clear non-technical explanations.
g. Confirming understanding (statement/question technique, reflective summary).
h. Written communication – purpose, content, presentation and style.
i. Providing a high quality service – fulfilling (ideally exceeding) customer expectations within agreed time frames.
j. Obtaining customer feedback and corrective actions when dissatisfaction expressed.
k. Dealing with complaints.

Company Products and Services

a. Service standards
    i. national
    ii. manufacturer
    iii. organisational
b. The range and type of services offered by the organisation.
    i. diagnostic.
    ii. servicing.
    iii. repair.
    iv. warranty.
    v. MOT testing.
    vi. fitment of accessories/enhancements.
    vii. internal.
c. The courses of action available to resolve customer problems.
    i. the extent and nature of the work to be undertaken.
    ii. the terms and conditions of acceptance.
    iii. the cost.
    iv. the timescale.
    v. required payment methods.

d. The effect of resource availability upon the receipt of customer vehicles and the completion of work.
    i. levels and availability of equipment.
    ii. levels and availability of technicians.
    iii. workshop loading systems.
e. How to access costing and work completion time information.
    i. manuals.
    ii. computer based.

Vehicle Information Systems, Servicing and Repair Requirements

a. Accessing technical data including diagnostics.
b. Servicing to manufacturer requirements/standards.
c. Repair/operating procedures.
d. MOT standards/requirements.
e. Quality controls – interim and final.
f. Requirements for cleanliness of vehicle on return to customer.
g. Handover procedures.

Consumer Legislation To include:

a. consumer protection
b. sale of goods
c. data protection
d. product liability
e. health and safety
f. discrimination

Assessment Requirements

Unit G37K – Knowledge of Supporting Customer Service Improvements in the Automotive Sector

Assessment Requirements

Unit AE01K – Knowledge of Locating and Correcting Simple Electrical Faults in the Automotive Workplace

Content:

Basic electrical principles

a. Explain the direction of current flow and electron flow.
b. These principles must include:
    i. volts
    ii. amps
    iii. ohms
    iv. power
    v. AC/DC
    vi. magnetism
    vii. electromagnetism
    viii. electromotive force
    ix. electromagnetic induction
    x. electrical heating effect
c. The terms used within these principles:
    i. volt (electrical pressure)
    ii. ampere (electrical current)
    iii. ohm (electrical resistance)
    iv. watt (power)
d. Calculations for the basic principles:
    i. amps
    ii. Ohms
    iii. volts
    iv. watts
e. Circuit principles to include:
    i. series circuits
    ii. parallel circuits
    iii. current flow
    iv. voltage of components
    v. volt drop
    vi. resistance
    vii. the effect on circuit operation of open circuit component(s)
f. Earth and insulated return systems.
g. Cable sizes and colour codes.
h. Different types of connectors, terminals and circuit protection devices.
i. Meaning of and checks for:
    i. short circuit
    ii. open circuit
    iii. bad earth
    iv. high resistance
    v. security
    vi. functionality
    vii. performance to specific

Vehicle and electrical unit wiring diagrams

a. Describe and identify vehicle and unit electrical symbols

b. Interpret information from vehicle wiring diagrams.
   i. vehicle systems
   ii. electrical units
   iii. wire colour and size
   iv. earth locations
   v. wiring junction locations
   vi. fuse size and location
   vii. connection pin numbers

Safety procedures and precautions when working on electrical and electronic systems

a. Safety precautions when working on electrical and electronic systems to include:
   i. avoidance of short circuits
   ii. power surges
   iii. prevention of electric shock
   iv. protection of electrical and electronic components.
   v. protection of circuits from overload or damage

Electrical test equipment, its function and correct use

a Equipment to include:
   i. voltmeters
   ii. ammeters
   iii. ohmmeters
   iv. lock torque testers
   v. regulator testers
   vi. insulation testers
   vii. oscilloscopes
   viii. specialist test equipment

Different types of Batteries

a Identify various types
   i. lead acid – conventional
   ii. maintenance free
   iii. gel
   iv. alkaline
   v. sodium.

Battery structure and chemical composition

a Lead-acid and alkaline batteries:
   i. construction
   ii. capacity
   iii. rating
   iv. reserve capacity
   v. cranking rating
   vi. polarity
   vii. electrochemical action
   viii. electrolyte type

Battery maintenance and charging

a Maintenance including:
   i. cleaning terminals and battery tops
   ii. protecting terminals
   iii. cell top-up for non-sealed units
   iv. securing to the vehicle
   v. removal and refitting procedures

b Charging to include:

i. trickle charging
ii. boost charging
iii. charging rates
iv. safe charging techniques
v. charging equipment

Lead-acid battery testing techniques and identify basic battery faults

a Testing techniques for:
i. testing of electrolyte
ii. high rate discharge testing
iii. testing equipment.

b Faults including:
i. low charge
ii. battery not holding charge
iii. sulphating
iv. battery voltage drop during different component operation
v. damaged plates and insulators

Different types of generators

a. Dynamos and regulators.
b. Alternators with internal and external regulators.

Charging principles and function of generators

a Charging principles:
i. supply current demands
ii. battery charging
iii. constant voltage at different engine speeds

Components of generators

a Dynamo and alternator components:
i. field coils
ii. armature
iii. brush assemblies
iv. alternator stator
v. rotor
vi. slip rings
vii. rectifier
viii. end frame packs
ix. bearings
x. regulator
xi. drive system

Basic testing procedures and identify charging system faults

a Basic test procedures:
i. testing of generator outputs (under and off load)
ii. testing for rectification and regulation
iii. removal and fitting procedure
iv. bench testing
v. vehicle testing

a. Faults to include:
i. slipping drive belt
ii. corroded or loose connections
iii. secure mounting
iv. not charging
v. noisy operation

Types, structure and operating principles of starter motors

a Starter motor types:
- i. pre-engaged
- ii. permanent magnet for heavy and diesel vehicles.
- iii. Add gear reduction to starter motor types

b Components to include:
- i. solenoid
- ii. armature
- iii. commutator
- iv. brush assemblies
- v. drive systems
- vi. ignition switches

Basic common faults and testing procedures for starter motors

a Basic test to include:
- i. pre-engaged
- ii. permanent magnet for heavy and diesel vehicles and light vehicle
- iii. gear reduction starters
- iv. wiring related to the circuits
- v. ignition switches
- vi. removal and refitting procedures

a. Faults to include:
- i. starter not engaging
- ii. slow engine cranking speed
- iii. insecure mounting

Types of ignition systems and ignition fundamentals

a Ignition system types:
- i. conventional
- ii. electronic
- iii. programmed
- iv. distributorless

b. Ignition system functional requirements.

The function of ignition components

a Components to include:
- i. ignition switch
- ii. coil
- iii. distributor
- iv. spark plugs
- v. leads
- vi. ballast resistor
- vii. contact breakers
- viii. condenser
- ix. electronic systems

Testing procedures and basic common faults relating to the ignition system

a. Testing procedures relating to the ignition system and components including:
- i. wiring
- ii. connections
- iii. switching of the primary circuit
- iv. removal and refitting procedures.

b. Failing to start and running erratic

The operating principles of the fuel system

Different fuel types and the relevant combustion process.

a. Fuel and air mix
b. Compression ratios
c. Exhaust emissions.

The different types of fuel system and components

a. Petrol fuel systems and components:
    i. Carburettor
    ii. Choke
    iii. fuel cut off
    iv. stepper motors
    v. sensors
    vi. injectors
    vii. fuel pumps
    viii. relays
    ix. cold start
    x. anti run on solenoid
    xi. lambda sensors
    xii. idle control actuators
    xiii. single and multipoint injection systems
b. Compression ignition systems:
    i. engine stop solenoid
    ii. injectors
    iii. fuel pumps
    iv. relays
    v. heater plugs
    vi. injection pumps
    vii. filters

Test procedures and basic common faults associated electronic elements of fuel systems and components

a. Basic testing procedures:
    i. diesel engine failing to start
    ii. failing to stop when switched off
    iii. petrol engine not starting
    iv. difficult to start when cold

The function of the engine management system and its components

a. Describe the engine management working processes:
b. System component including:
    i. pulse, hall, optimum inductive generators
    ii. ECU
    iii. control modules
c. Sensors including:
    i. crankshaft
    ii. manifold
    iii. temperature
    iv. knock

Different types of components

a. Components to include:
    i. constant energy systems
    ii. pulse generators
    iii. hall effect generators

iv. optimum inductive pulse generators
v. modules
vi. ECU
vii. sensors

Basic common faults and testing methods associated with engine management systems

a. Basic faults and tests to include:
   i. engine fails to start
   ii. erratic running
   iii. poor fuel consumption
   iv. poor connections
b. Removal and replacement procedures.

The different lighting system components

a. Components to include:
   i. side and tail lights
   ii. brake lights
   iii. reverse lights
   iv. rear and front fog lights
   v. headlights
   vi. driving lights
   vii. spot lights
   viii. indicators
   ix. headlamp trim motors
   x. index lights

The function of component parts

a. Components to include:
   i. lamp holders
   ii. bulbs
   iii. relays
   iv. switches
   v. warning systems
   vi. trim motors

Basic common faults and testing methods associated with external lighting system

a. Faults relating to:
   i. switches
   ii. relays
   iii. lamp holders
   iv. wiring
   v. connections
   vi. fuses and fuse ratings
   vii. headlamp alignment

The operating principles of external lighting systems

a. Principles including:
   i. side and tail lights
   ii. brake lights
   iii. reverse lights
   iv. rear and front fog lights
   v. headlights
   vi. spot lights
   vii. indicators

Assessment Requirements

Unit AE02K – Knowledge in Enhancing Vehicle Electrical Systems

Content:

The different types of I.C.E. systems and components

a. Systems and components to include:
   i. radio/CD players
   ii. multi-play CD players
   iii. DVD
   iv. MP3 players
   v. speakers
   vi. aerial systems
   vii. amplifiers
   viii. visual display screens
   ix. satellite navigation
   x. mobile communication units

The function of component parts in the I.C.E. systems

a. Components include:
   i. radio
   ii. CD
   iii. video
   iv. DVD players
   v. aerial systems
   vi. speakers
   vii. amplifiers
   viii. visual display screens
   ix. mobile communication systems

The operating principles of I.C.E systems

a. Operation of entertainment systems speaker systems and aerial systems.

The relevant legislation relevant to I.C.E systems

a. Find and apply all relevant legislation for the fitment and use of I.C.E systems.

Basic common faults and testing methods associated I.C.E. systems

a. Test and procedures for the following:
   i. radio/CD players
   ii. speakers
   iii. aerial systems
   iv. amplifiers
   v. wiring
   vi. connections
   vii. relays
   viii. fuses
   ix. removal and refitting procedures

Types of security/warning systems and components

   i. components to include:

ii. control units
iii. alarm modules
iv. audible warning units
v. immobiliser units
vi. sensing units
vii. horn
viii. audible warning speakers

The function of component parts in 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. diodes
viii. horns

The operating principles of 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.

Basic common faults and testing methods associated security and warning systems

a. Components to include:
i. control units
ii. audible warning units
iii. immobiliser units
iv. horns
v. relays
vi. diodes
vii. wiring
viii. connections and protection devices
ix. removal and refitting procedures

The different types of safety fitment systems and components

a. Components to include:
i. reversing aids and systems
ii. working lamps
iii. driving lamps
iv. additional fog lights
v. fuel cut off switches
vi. engine cut off switches

The function of component parts in safety fitment systems

a. Components to include:

i. reversing aids and systems
ii. working lamps
iii. driving lamps
iv. additional fog lights
v. fuel cut off switches
vi. engine cut off switches

The operating principles of safety fitment systems

a. The following safety fitments:
   i. reversing aids and systems
   ii. working lamps
   iii. driving lamps
   iv. additional fog lights
   v. fuel cut off switches
   vi. engine cut off switches

The relevant legislation relevant to safety fitment systems

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

Basic common faults and testing methods associated with safety fitment systems

a. To include the following systems and components:
   i. control units
   ii. components
   iii. horns
   iv. relays
   v. diodes
   vi. wiring
   vii. connections
   viii. protection devices
   ix. removal and refitting procedures

The different types of towing systems and components

a. Components to include:
   i. reversing aids and systems
   ii. towbar mounting systems
   iii. single and double plug wiring systems
   iv. audible warning systems
   v. split charging systems
   vi. trailer lighting board

The function of component parts in towing systems

a. Components must include:
   i. reversing aids
   ii. towbar
   iii. wiring connectors
   iv. audible warning systems
   v. visible warning systems
   vi. split charge control units
   vii. relays
   viii. lighting boards

The operating principles of towing systems

a. Principles to include:
   i. reversing aids
   ii. 7 pin plug systems
   iii. vehicle lighting systems
   iv. audible warning systems
   v. visible warning systems
   vi. split charge systems

The relevant legislation relevant to Towbar systems

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

Basic common faults and testing methods associated with towing systems

a. Basic faults and tests to include:
    i. lighting systems
    ii. split charge systems
    iii. warning systems
    iv. reversing aid systems
    v. earth faults
    vi. voltage test methods
    vii. resistance testing
    viii. functional tests

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Assessment Requirements

Unit AE03K – Knowledge of Overhauling Electrical Units

Content:

The various types of generators fitted to motor vehicles

a. Generators must include:
   i. alternator with an internal regulator
   ii. alternator with an external regulator
   iii. alternator with a separate regulator
   iv. DC generators

The operating principles of each generator

a. Generators must include:
   i. alternators with an internal regulator
   ii. alternators with an external regulator
   iii. alternators with a separate regulator
   iv. DC generators

The components and how they function within each type of generator

a. Generators must include:
   i. alternators with an internal regulator
   ii. alternators with an external regulator
   iii. alternators with a separate regulator
   iv. DC generators
b. Components must include:
   i. rotors
   ii. stators
   iii. rectifiers
   iv. regulator
   v. slip rings
   vi. bearings
   vii. housings
   viii. fans and pulleys
   ix. armatures
   x. field windings
   xi. brushes and brush boxes
   xii. surge protection diode

Test each component within each type of generator

a. Generators must include:
   i. alternators with an internal regulator
   ii. alternators with an external regulator
   iii. alternators with a separate regulator
   iv. DC generators
b. Components must include:
   i. rotors
   ii. stators
   iii. rectifiers
   iv. regulator
   v. slip rings
   vi. bearings

vii. housings
viii. fans and pulleys
ix. armatures
x. field windings
xi. brushes and brush boxes
xii. surge protection diode

c. Tools must include:
i. voltmeters
ii. ammeters
iii. ohmmeters
iv. insulation testers
v. regulator testers

Symptoms and faults associated with basic generators

a. Generators must include:
i. alternators with an internal regulator
ii. alternators with an external regulator
iii. alternators with a separate regulator
iv. DC generators

Test procedures for the repaired generators and evaluate the results

a. Generators must include:
i. alternators with an internal regulator
ii. alternators with an external regulator
iii. alternators with a separate regulator
iv. DC generators

b. Tools must include:
i. voltmeters
ii. ammeters
iii. specialist test equipment

The various types of starter motor fitted to motor vehicles

a. Starter motors must include:
i. inertia starter motors
ii. pre-engaged starter motors
iii. axial starter motors
iv. co-axial starter motors

The operating principles of each type of starter motor

a. Starter motors must include:
i. pre-engaged starter motors
ii. axial starter motors
iii. co-axial starter motors
iv. gear reduction starters add

The components and how they function within each type of starter motors

a. Starter motors must include:
i. pre-engaged starter motors
ii. axial starter motors
iii. co-axial starter motors
iv. gear reduction starters add

b. Components must include:
i. armatures
ii. field windings
iii. brushes and brush boxes

iv. bearings and bushes
v. solenoids
vi. drive gears and clutches
vii. housings
viii. fans and pulleys
ix. reduction gears

Test each component within each type of starter motors

a. Starter motors must include:
i. pre-engaged starter motors
ii. axial starter motors
iii. co-axial starter motors
iv. gear reduction starters. add

a. Components must include:
i. armatures
ii. field windings
iii. brushes and brush boxes
iv. bearings and bushes
v. solenoids
vi. drive gears and clutches
vii. housings
viii. fans and pulleys
ix. reduction gears

c. Tools must include:
i. voltmeters
ii. ammeters
iii. ohmmeters
iv. insulation testers

Symptoms and faults associated with starter motors

a. Starter motors must include:
i. pre-engaged starter motors
ii. axial starter motors
iii. co-axial starter motors
iv. gear reduction. add

Tests and adjustment procedures for the repaired starter motors and evaluate the results

a. Starter motors must include:
i. pre-engaged starter motors
ii. axial starter motors
iii. co-axial starter motors
iv. gear reduction add

b. Tools must include:
i. voltmeters
ii. ammeters
iii. specialist test equipment
iv. lock torque testers

Assessment Requirements

Unit AE04K – Knowledge of Diagnosis and Rectification of Engine Electrical Faults

Content:

Advanced battery technology

a. Batteries must include:
   i. maintenance free
   ii. sodium-nickel-chloride
   iii. fuel cell
   iv. sodium sulphur and swing lead acid
   v. fuel cell
b. Electrochemistry.
c. Calculation on battery efficiency/rating.

Battery condition and faults

a. Faults including:
   i. battery not holding charge
   ii. unwanted drain
   iii. diluted electrolyte
   iv. Impurities in electrolyte
   v. excessive gassing
   vi. low state of charge
   vii. sulphating
   viii. excessive volt drop during component operation
   ix. open circuit cell
   x. overcharging
   xi. temperature related faults

Operating principles charging systems

a. Charging systems should include:
   i. alternators with internal and external regulators
   ii. water cooled alternators
   iii. integrated alternators (ISAD)
   iv. dynalto systems.
b. Electrical loads imposed by vehicle systems.
c. Rectification and regulation.

Test procedures for diagnosing faults with charging systems

a. Stages in the fault finding process to include:
   i. hand and eye checks
   ii. supply voltage
   iii. generator outputs
   iv. under and off load testing for rectification and regulation
   v. bench testing
   vi. vehicle testing.

Symptoms of faults found on charging systems.

a. Faults to include:
   i. charging light inoperative
   ii. charging light staying on all the time

iii. battery discharges during normal operation
iv. high resistance in charging circuits
v. loose broken wiring/connections

b. Internal faults:
i. diode open circuit
ii. worn brushes
iii. regulator faults
iv. rotor open circuit
v. stator open circuit

Advanced charging system technology.

a. Charge balance calculation.
b. Charging system problems and solutions including:
i. upgrading alternator
ii. power management systems
iii. two stage
iv. dual voltage systems

Advanced starting system technology

a. Outputs in relation to engine size:
i. speed
ii. torque
iii. power
iv. efficiency
b. System design characteristics:
i. DC motor characteristics
ii. parallel
iii. shunt
iv. compound
v. series
c. Electronic starter control.
d. High voltage systems.
e. Inhibitor circuits.
f. Starter types to include:
i. pre – engaged
ii. permanent magnet for heavy and diesel vehicles
iii. integrated starters

Faults and diagnostic procedures for starting systems.

a. Components to include:
i. solenoid
ii. armature
iii. commutator
iv. brush assemblies
v. drive systems
vi. ignition switches
vii. torque drive systems.
b. Faults to include:
i. battery
ii. wiring
iii. starter switch
iv. inhibitor switch
v. pinion
vi. flywheel
vii. bearings

viii. internal starter components

c. Identify stages of fault finding.

Ignition system technology

a. Components to include:
   i. ignition switch
   ii. oil packs
   iii. spark plugs and leads
   iv. distributors and amplifier units
   v. knock sensor
   vi. engine speed sensor
   vii. manifold sensor
   viii. coolant sensor
   ix. ECU
b. Materials used in component manufacture.
c. Systems top include:
   i. constant energy systems
   ii. hall effect
   iii. inductive pulse
   iv. open and closed loop
   v. distributorless ignition
   vi. direct ignition
   vii. advance angle timing
   viii. integrated ignition circuit

The construction of ignition components

a. Spark plugs including:
   i. heat range
   ii. electrode gap
   iii. choosing correct plug
b. Ignition components to include:
   i. ignition switch
   ii. coil packs and leads
   iii. resistors
   iv. amplifier units
   v. electronic systems

Faults and diagnostic procedures for ignition systems

a. Diagnostic equipment and procedures relating to the ignition system and components including:
   i. wiring, and connections
   ii. code readers
   iii. oscilloscopes
   iv. ohmmeter
   v. volt meter
   vi. other dedicated equipment
   vii. testing sequences
b. Faults to include:
   i. no spark
   ii. cold and hot starting problems
   iii. erratic running
   iv. damp components
   v. worn components
   vi. incorrect plug gaps
   vii. high resistance in circuit

viii. intermittent connections
ix. incorrect timing
x. coil or distributor cap tracking
xi. HT breaking down
xii. running on when switched off
xiii. pinking and knocking
xiv. misfire
xv. erratic idle
xvi. lack of power
xvii. backfire and fouling

The operation and requirements of fuel systems

a. Fuel systems to include:
   i. single point
   ii. multi point control layout
   iii. sequential multi point
   iv. diesel fuel injection
   v. petrol injection
   vi. computer controlled
   vii. lean burn
   viii. common rail
   ix. catalytic converters
b. Theories and terms to include:
   i. combustion
   ii. burn range and rate
   iii. detonation
   iv. mixture strength effects
   v. air-fuel ratios
   vi. fuelling and emissions
   vii. CoNox
   viii. HC
   ix. exhaust emission regulations

The function of fuel system components and the relationship between components

a. Petrol fuel systems:
   i. stepper motors
   ii. sensors
   iii. injectors
   iv. fuel pumps
   v. relays
   vi. cold start
   vii. lambda sensors
   viii. idle control actuators
   ix. single and multipoint injection systems
   x. throttle valve potentiometer
   xi. phase sensor
b. Compression ignition systems:
   i. engine stop solenoid
   ii. injectors
   iii. fuel pumps
   iv. relays
   v. heater plugs
   vi. injection pumps
   vii. High pressure pumps

viii. filters

c. Block, flow and circuit diagrams.

Faults and diagnostic procedures for fuel system systems

a. The stages of fault finding.
b. Diagnostic procedures for including:
    i. the use of fault code readers
    ii. oscilloscopes
    iii. break out boxes
    iv. on-board diagnostics
    v. other dedicated equipment
c. Faults:
    i. no fuel
    ii. filters dirty or blocked
    iii. fuel pump
    iv. hot and cold start
    v. erratic idle
    vi. misfire
    vii. stalling
    viii. lack of power
    ix. backfire
    x. incorrect co
    xi. air leaks

The operation of engine management components and relationship with vehicle systems

a. Components:
    i. ECU units
    ii. input sensors
    iii. output actuators
b. Data flow, distribution and interconnection
b. Control of phases:
    i. starting
    ii. enrichment
    iii. cold running
    iv. idle
    v. full load
    vi. acceleration
    vii. deceleration
    viii. engine speed limitation
d. CANBUS.
e. Performance mapping implications.
f. Block, flow and circuit diagrams.

Faults and diagnostic procedures for engine management systems

a. The stages of fault finding.
b. Diagnostic procedures including:
    i. the use of fault code readers
    ii. oscilloscope
    iii. break out boxes
    iv. on-board diagnostics
    v. other dedicated equipment
c. Faults:
    i. engine fails to start
    ii. hot and cold start
    iii. erratic idle

iv. misfire
v. hesitation under acceleration or constant speed
vi. knock
vii. poor response
viii. poor fuel consumption
ix. incorrect CO
x. poor performance
xi. limp home mode
xii. fuses

Adjustments to components are:

a. settings
b. input and output values
c. voltages
d. current consumption
e. resistance
f. output patterns with oscilloscope
g. condition
h. wear and performance

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Assessment Requirements

Unit AE05K – Knowledge of Diagnosis and Rectification of Transmission and Chassis Electrical Faults

Content:

Identification of various types of electrical/electronic transmission control systems
a. Electronic clutch control, torque converter control systems.
b. Electronically controlled manual transmission/powershift.
c. Electronically controlled automatic transmission.
d. Retarders and diff-lock systems

The function and operating principles of each of these areas
a. Electronic clutch control, torque converter control systems.
b. Electronically controlled manual transmission/powershift.
c. Electronically controlled automatic transmission.
d. Retarders and diff-lock systems.

Common faults and basic tests for these systems
a. Hand held diagnostics, meters and oscilloscopes.
b. Electronic Clutch Control, torque converter control systems.
c. Electronically controlled manual transmission/powershift.
d. Electronically controlled automatic transmission.
e. Retarders and diff-lock systems.

The function and operating principles of the following systems
a. ABS
b. Traction control.

Identification of components and their function within the system
a. Sensors, actuators, modulators and the control system for ABS.
b. Sensors, actuators, modulators and the control system for traction control.

Common faults and basic tests for these systems
a. ABS
b. Traction control

Function and operating principles of steering systems
a. Electro/hydraulic systems.
b. Speed sensitive systems.
c. Full electric assistance systems.
d. 4 Wheel steering systems.

Identification of all components and their function within the steering system
a. Sensors, actuators and control systems for each system.

Common faults and basic tests for these steering systems
a. Electro/hydraulic systems.
b. Speed sensitive systems.
c. Full electric assistance systems.

Function and operating principles of electric/electronic suspension control
a. Sensors, actuators and control systems
b. Hydra-electric systems
c. Pneumatic electric

Identification of all components and their function within the suspension systems
a. Sensors, actuators and control systems
b. Hydra-electric systems
c. Pneumatic electric

Common faults and basic tests for these suspension systems
a. Sensors, actuators and control systems
b. Hydra-electric systems
c. Pneumatic electric

How the below systems come together to create a stability control system
a. Aerodynamic control systems
b. Transmission systems
c. ABS/traction control systems
d. Steering systems
e. Suspension systems
f. Engine management system

Identification and description how all these systems unite to create stability control
a. Aerodynamic control systems
b. Transmission systems
c. ABS/traction control systems
d. Steering systems
e. Suspension systems
f. Engine management system

Common faults and basic tests for these combined systems
a. Aerodynamic control systems
b. Transmission systems
c. ABS/traction control systems
d. Steering systems
e. Suspension systems
f. Engine management system

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

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

Assessment Requirements

Unit AE07K – Knowledge of Fitting Auxiliary Locks and Security Devices (Electrical & Mechanical)

Content:

The identification of different types of auxiliary locks and security devices components

a. Systems and components to include:
   i. electronic/electro mechanical lock mechanisms
   ii. additional auxiliary mechanical door locks using cylinder type locks
   iii. additional auxiliary mechanical door/aperture locks using external locking systems
   iv. mechanical window protection devices (internal and external)
   v. replacement security windows/ window security films
   vi. pneumatic locking systems

The function of components in the auxiliary locks and security devices components

b. Components include:
   i. electronic/electro mechanical lock mechanisms
   ii. additional auxiliary mechanical door locks using cylinder type locks
   iii. additional auxiliary mechanical door/aperture locks using external locking systems
   iv. mechanical window protection devices (internal and external)
   v. replacement security windows/ window security films
   vi. pneumatic locking systems

The operating principles of auxiliary locks and security systems

a. Systems include:
   i. electronic/electro mechanical lock mechanisms
   ii. additional auxiliary mechanical door locks using cylinder type locks
   iii. additional auxiliary mechanical door/aperture locks using external locking systems
   iv. mechanical window protection devices (internal and external)
   v. replacement security windows/ window security films
   vi. pneumatic locking systems

The relevant legislation relevant to the auxiliary locks and security systems

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

Faults and testing methods associated with auxiliary locks and security systems

a. Test and procedures for the following:
   i. lock mechanisms
   ii. cylinder locks
   iii. external locks
   iv. window protection devices
   v. pneumatic locks

Assessment Requirements

Unit AE08K – Knowledge of Inspecting Vehicles Using Proscribed Methods

Content:

Pre and post work vehicle inspections and record findings

a. PPE and vehicle protection relating to:
    i. vehicle body panels
    ii. paint surfaces
    iii. seats
    iv. carpets and floor mats prior to conduction vehicle inspections
b. Pre and post work vehicle inspection procedures:
    i. aural
    ii. visual and functional assessments on engine
    iii. engine systems
    iv. chassis systems
    v. wheels and tyres
    vi. transmission system
    vii. electrical and electronic systems
    viii. exterior vehicle body
    ix. vehicle interior
c. The methods for carrying out inspections for: damage, corrosion, fluid leaks, wear, security, mounting security and condition to include;
    i. engines and engine systems
    ii. chassis systems
    iii. brakes
    iv. steering
    v. suspension
    vi. wheels
    vii. tyres
    viii. body panels
    ix. electrical and electronic systems and components
    x. vehicle seating and vehicle interior
    xi. vehicle instrumentation
    xii. driver controls
d. Check conformity to manufacturer's specifications and legal requirements.
e. Completion of documentation to include:
    i. inspection records
    ii. job cards
    iii. vehicle records
f. Make recommendations based on results of vehicle inspections.
g. The checks necessary to ensure customer satisfaction for:
    i. vehicle body panels
    ii. paint surfaces
    iii. seats
    iv. carpets and floor mats following pre or post vehicle inspections
h. Prepare and use appropriate inspection equipment and tools.
i. Inspection procedures following inspection checklists.

Assessment Requirements

Unit AE09K – Knowledge of the Suitability, Installation and Configuration of Vehicle Electrical Enhancements and Security Systems

Content:

The different types of electrical enhancement systems and components

a. Systems and components to include:
   i. radio/CD players
   ii. multi-play CD players
   iii. DVD
   iv. MP3 players
   v. speakers
   vi. aerial systems
   vii. amplifiers
   viii. visual display screens
   ix. satellite navigation
   x. mobile communication units
   xi. networking systems
   xii. body electrical systems
   xiii. data logging

The function of component parts in the electrical enhancement systems

c. Components include:
   i. Radio
   ii. CD
   iii. Video
   iv. DVD players
   v. aerial systems
   vi. speakers
   vii. amplifiers
   viii. visual display screens
   ix. mobile communication systems
   x. networking systems
   xi. body electrical systems
   xii. data logging

The operating principles of electrical enhancement systems

   i. in car entertainment
   ii. audio systems
   iii. communication systems
   iv. networking systems
   v. body electrical systems

The relevant legislation relevant to the electrical enhancement systems

a. Find and apply all relevant legislation for the fitment and use of I.C.E systems.

Faults and testing methods associated electrical enhancement systems

a. Test and procedures for the following:
   i. radio/CD players
   ii. speakers

iii. aerial systems
iv. amplifiers
v. wiring
vi. connections
vii. relays
viii. fuses
ix. removal and refitting procedures
x. networking systems
xi. body electrical systems
xii. data logging

Types of security/warning systems and components

i. components to include:
ii. control units
iii. alarm modules
iv. audible warning units
v. immobiliser units
vi. location/tracking units
vii. electronic deadlocking units
viii. sensing units
ix. horn
x. audible warning speakers

The function of component parts in security and warning systems

b. Components to include:
i. control units
ii. alarm modules
iii. audible warning units
iv. interior sensing systems
v. immobiliser units
vi. location/tracking units
vii. electronic deadlocking units
viii. relays
ix. diodes
x. horns

The operating principles of security and warning systems

a. Operation of alarm systems and audible warning units.
b. Immobiliser systems
c. Location/tracking systems
d. Electronic deadlocking systems

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.

Faults and testing methods associated security and warning systems

a. Components to include:
i. control units
ii. audible warning units
iii. immobiliser units
iv. horns
v. relays
vi. diodes
vii. wiring
viii. connections and protection devices

ix. removal and refitting procedures

Assessment Requirements

Unit AE10K – Knowledge of Conducting Vehicle Enhancement and Installation Consultations with Customers in the Motor Vehicle Environment

Content:

The identification of different types of electrical enhancement systems and components

a. Systems and components to include:
   i. radio/CD players
   ii. multi-play CD players
   iii. DVD
   iv. MP3 players
   v. speakers
   vi. aerial systems
   vii. amplifiers
   viii. visual display screens
   ix. satellite navigation
   x. mobile communication units
   xi. networking systems
   xii. body electrical systems

The function of component parts in the electrical enhancement systems

d. Components include:
   i. radio
   ii. CD
   iii. video
   iv. DVD players
   v. aerial systems
   vi. speakers
   vii. amplifiers
   viii. visual display screens
   ix. mobile communication systems
   x. networking systems
   xi. body electrical systems
   xii. data logging

The operating principles of electrical enhancement systems

a. Operation of electrical enhancement systems
   i. in car entertainment
   ii. audio systems
   iii. communication systems
   iv. networking systems
   v. body electrical systems

The relevant legislation relevant to the electrical enhancement systems

a. Find and apply all relevant legislation for the fitment and use of electrical enhancement systems.

Show positive personal image

a. The importance of achieving and maintaining a physical appearance suitable for the motor industry
b. Why it is important to maintain good personal appearance whilst working in the motor industry
c. The use of simple body language such as body posture, eye contact and smiling and recognize it in others
d. How to meet and greet customers and recognize the importance of making acustomer feel welcome
e. How to start conversations.

Respond to different types of motor industry customer

a. Why it is important to be able to assist all customers equally
b. How best to assist customers with physical needs
c. How best to assist customers with sensory needs
d. How best to assist customers with learning needs
e. How best to assist customers from other cultures
f. The communication methods best suited to the needs of the individual customer

Respond to a motor industry customer by telephone

a. The importance of using the correct greeting for incoming calls
b. The correct methods for dealing with telephone enquiries
c. The importance of obtaining and providing names
d. The importance of creating a positive impression on the telephone
e. Why it is important to record information
f. Select the correct questioning techniques used to obtain information over the telephone
g. The correct procedures for dealing with telephone calls.

Handle motor industry customer complaints

a. The variety of emotions customers may display when complaining
b. Identify that some customers are experienced at complaining and will need to be assisted in a specific manner
c. Explain that some unhappy customers may be reluctant to complain and they will need to be made to feel comfortable to do so
d. Explain why it is important to try to resolve a customer's complaint
e. Identify the importance of active listening
f. Explain how to approach a customer
g. Recognise the limits of their own authority and who to refer to when customer requests are outside own limitations.

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Assessment Requirements

Unit BP18K – Knowledge of Removing and Fitting Basic Light Vehicle Mechanical, Electrical and Trim (MET) Components and Non Permanently Fixed Vehicle Body Panels

Content:

Describe procedures to prevent damage to the vehicle, components and contents when removing, storing and refitting basic MET components

a. The methods that can be used to protect undamaged items to ensure they are removed and refitted without causing unnecessary damage:
   i. bumpers
   ii. headlamp units
   iii. road wheels
   iv. batteries
   v. bonnet and boot trim
   vi. interior trim components
   vii. exterior trim components

b. The procedures for the correct storage of vehicle contents.

c. The process for the reporting of extra damage and items that may have broken when removed or refitted.

The processes involved when handling batteries

a. The procedure for the removal, storage and refitting of lead acid batteries.
b. The procedure for the disposal of lead acid batteries.
c. Battery checks:
   i. electrolyte
   ii. discharge
   iii. specific gravity
d. The charging process and procedures:
   i. trickle charge
   ii. normal charge
   iii. boost / start
e. The health and safety issues involved when charging (explosive gasses).

Types of clips and fixings

a. The following types of clips and identify reasons and limitations for their use:
   i. speed
   ii. ‘c’
   iii. ‘d’
   iv. ‘j’ type captive nut
   v. ‘r’
   vi. ‘u’ type captive nut
   vii. cable clip
   viii. trim clips
b. The following types of fixings and identify reasons and limitations for their use:
   i. pop rivet
   ii. plastic rivet
   iii. plastic capture nut
   iv. nut and bolt
   v. soulder bolt

vi. 'Nyloc' type nuts
vii. washers
viii. 'Spring' type washers
ix. self tapping screws and bolts
x. quick release plastic trim fastenings
xi. trim tapes
xii. adhesives and sealers

The processes involved when carrying out quality checks

a. Items that may have been 'workshop' soiled and describe processes for rectifying:
   i. door cards
   ii. seats
   iii. carpets
   iv. boot and bonnet trims
b. Methods for checking gaps.
c. The process for checking and aligning headlamps:
   i. address handling procedures for halogen bulbs
   ii. address handling and health and safety issues relating to xenon bulbs and systems
d. Operational checks and rectification methods to include:
   i. lights
   ii. washers and wipers
   iii. SRS systems (checking not rectification)
   iv. charging system (checking not rectification)
   v. horn
   vi. fluid levels
   vii. interior switches
   viii. operation of door lock mechanisms

Removing and Fitting Non-Structural Body Panels

a. Find, interpret and use sources of information applicable to the removal and fitting of basic non welded non-structural body panels.
b. Select check and use all the tools and equipment required to remove and fit basic non welded non-structural body panels including:
   i. hinge pin removers
   ii. spanners
   iii. screwdrivers
c. The different types of mechanical fixings for non welded non-structural body panels and when and why they should be used including:
   i. bolts
   ii. self tapping bolts
   iii. speed nuts
   iv. washers
d. The correct procedures and processes for removing and fitting of non welded non-structural body panels.
e. The need for correct alignment of panels and methods to achieve this:
f. Aperture gaps
g. Alignment of panel features
h. Best fit of components to panels
i. Vehicle geometry
j. Operation of openings such as doors, tailgates, bonnets etc.
k. The types of quality control checks that can be used to ensure correct alignment and contour of panels and operation of components to manufacturer's specification.
l. The method of storing removed panels and the importance of storing them correctly.

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Assessment Requirements

Unit LV03K – Knowledge of Light Vehicle Electrical Units and Components

Content:

Electrical/Electronic Principles

a. Electrical units:
   i. volt (electrical pressure)
   ii. ampere (electrical current)
   iii. ohm (electrical resistance)
   iv. watt (power)
b. The requirements for an electrical circuit:
   i. battery
   ii. cables
   iii. switch
   iv. current consuming device
   v. continuity
c. The direction of current flow and electron flow.
d. Series and parallel circuits to include:
   i. current flow
   ii. voltage of components
   iii. volt drop
   iv. resistance
   v. the effect on circuit operation of open circuit component(s)
e. Earth and insulated return systems.
f. Cable sizes and colour codes.
g. Different types of connectors, terminals and circuit protection devices.
h. Common electrical and electronic symbols.
i. The meaning of:
   i. short circuit
   ii. open circuit
   iii. bad earth
   iv. high resistance
   v. electrical capacity
j. The principles of vehicle electronic systems and component.
k. Interpret vehicle wiring diagrams to include:
   i. vehicle lighting
   ii. auxiliary circuits
   iii. indicators
   iv. starting and charging systems
l. Function and construction of electrical components including:
   i. circuit relays
   ii. bulb types
   iii. fan and heater
   iv. circuit protection
m. The safety precautions when working on electrical and electronic systems to include:
   i. disconnection and connection of battery
   ii. avoidance of short circuits
   iii. power surges
   iv. prevention of electric shock
   v. protection of electrical and electronic components

vi. protection of circuits from overload or damage

n. The set-up and use of:
   i. digital and analogue multi-meters
   ii. voltmeter
   iii. ammeter
   iv. ohmmeter
   v. oscilloscope
   vi. manufacturer's dedicated test equipment

o. Electrical and electronic checks for electrical and electronic systems to include:
   i. connections
   ii. security
   iii. functionality
   iv. performance to specifications
   v. continuity, open circuit
   vi. short circuit
   vii. high resistance
   viii. volt drop
   ix. current consumption
   x. output patterns (oscilloscope)

p. Symptoms and faults associated with electrical and electronic systems to include:
   i. high resistance
   ii. loose and corroded connections
   iii. short circuit
   iv. excessive current consumption
   v. open circuit
   vi. malfunction
   vii. poor performance
   viii. battery faults to include flat battery
   ix. failure to hold charge
   x. low state of charge
   xi. overheating
   xii. poor starting

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

c. The layout, construction and operation of engine starting systems: inertia and pre-engaged principles.

d. 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

a. Function and construction of electrical components including:
   i. front and tail lamps
   ii. main and dip beam headlamps
   iii. fog and spot lamps
   iv. lighting and dip switch
   v. directional indicators

b. The circuit diagram and operation of components for:
   i. side and tail lamps
   ii. headlamps
   iii. interior lamps
   iv. fog and spot lamps
   v. direction indicators

e. The statutory requirements for vehicle lighting when using a vehicle on the road.

d. Headlamp adjustment and beam setting.

Auxiliary Systems

a. Function and construction of electrical components including:
   i. central door locking
   ii. anti theft devices
   iii. manual locking and dead lock systems
   iv. window winding
   v. demisting systems
   vi. door mirror operation mechanisms
   vii. interior lights and switching
   viii. sun roof operation

b. The circuit diagram and operation of components for:
   i. central door locking
   ii. anti theft devices
   iii. manual locking and dead lock systems
   iv. window winding
   v. demisting systems
   vi. door mirror operation mechanisms
   vii. sun roof operation

c. Comfort and convenience systems to include:
   i. heated seats
   ii. electrically adjusted seats
   iii. heated screens
   iv. electric mirrors
   v. heating
   vi. climate control
   vii. air conditioning

General

a. The preparation, testing and use of:
    i. tools and equipment
    ii. electrical meters and equipment used for dismantling
    iii. removal and replacement of electrical and electronic systems and components
b. Appropriate safety precautions:
    i. PPE
    ii. vehicle protection when dismantling
    iii. removal and replacing electrical and electronic components and systems
c. The important of logical and systematic processes.
d. Preparation of replacement units for re-fitting or replacement electrical and electronic components and systems.
e. The reasons why replacement components and units must meet the original specifications (OES) – warranty requirements, to maintain performance, safety requirements.
f. Refitting procedures.
g. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
h. Inspection and re-instatement of the vehicle following repair to ensure:
    i. customer satisfaction
    ii. cleanliness of vehicle interior and exterior
    iii. security of components and fittings
    iv. re-instatement of components and fittings