Unit 163  Knowledge of Diagnosis and Rectification of Light Vehicle Transmission and Driveline Faults

UAN: D/601/3741
Level: Level 3
Credit value: 6
GLH: 45
Relationship to NOS: This unit is linked to LV13 Diagnose and Rectify Motor Vehicle Transmission and Driveline System Faults.

Assessment requirements specified by a sector or regulatory body: This unit is endorsed by IMI, the Sector Skills Council for the automotive retail industry.

Aim: This unit enables the learner to develop an understanding of diagnosis and rectification of light vehicle gearboxes, hubs and bearings, driveline shafts, clutches, differentials and final drive units. It also covers the evaluation of performance of the systems.

Learning outcome | The learner will:
1. Understand how the light vehicle transmission and driveline systems operate

Assessment criteria
The learner can:
1.1. Explain the construction and operation of light vehicle transmission and driveline systems
1.2. Explain the interaction between electrical, electronic and mechanical components within light vehicle transmission and driveline systems
1.3. Explain how electrical systems interlink and interact, including multiplexing
1.4. Compare light vehicle transmission and driveline system components and assemblies against alternatives to identify differences in construction and operation
1.5. Identify the engineering principles that are related to light vehicle transmission and driveline systems
   a. friction
   b. torque transmission
   c. materials
   d. fluids & energy
   e. potential & kinetic energy.
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<th><strong>Learning outcome</strong></th>
<th>The learner will:</th>
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<td>2.</td>
<td>Understand how to diagnose and rectify faults in light vehicle transmission and driveline systems</td>
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**Assessment criteria**

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<th>The learner can:</th>
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<td>2.1. Explain the symptoms and causes of faults found in light vehicle transmission and driveline systems</td>
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<td>2.2. Explain systematic diagnostic techniques used in identifying transmission and driveline system faults</td>
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<td>2.3. Explain how to examine, measure and make suitable adjustments components</td>
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<td>2.4. Explain how to carry out the rectification activities in order to correct the faults in light vehicle transmission and driveline systems</td>
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<td>2.5. Explain how to select, prepare and use diagnostic and rectification equipment for light vehicle transmission and driveline systems</td>
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<td>2.6. Explain how to evaluate and interpret test results found in diagnosing light vehicle transmission and driveline system faults against vehicle manufacturer specifications and settings</td>
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<td>2.7. Explain how to evaluate the operation of components and systems following diagnosis and repair to confirm system performance.</td>
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Supporting information

Evidence requirements
The evidence requirements are shown in full in the assessment documentation.

Unit range
Electrical and electronic principles related to light vehicle transmission systems
The operation of electrical and electronic systems and components related to light vehicle transmission systems including:
   i. ECU
   ii. sensors and actuators
   iii. electrical inputs & outputs
   iv. voltages
   v. oscilloscope patterns
   vi. digital and fibre optic principles

The interaction between the electrical/electronic system, hydraulic system and mechanical components of the transmission systems
Electronic and electrical safety procedures
The operation light vehicle clutches and fluid couplings
The construction and operation of friction clutches (coil spring, diaphragm) including single and twin clutch designs

The construction and operation of fluid couplings including:
   i. fluid flywheel
   ii. torque converter (torque multiplication, efficiency)
   iii. benefits of fluid couplings
   iv. benefits of torque converter over fluid flywheel

The operation of light vehicle transmissions and driveline systems
The construction and operation of manual gearboxes:
   i. 4, 5 & 6 speed gearboxes
   ii. gear arrangements
   iii. shaft and bearing arrangements
   iv. synchronmesh devices
   v. interlock mechanisms
   vi. linkages
   vii. overdrive
   viii. lubrication
The construction and operation of automatic gearboxes including hydraulic and electronic control systems: operations of epicyclic gears (sun, planet, annulus and carrier), method for achieving different gear ratios using epicyclic gearing; hydraulic control systems, components and operation; electronic control system, components and operation.

The construction and operation of continuously variable transmissions (CVT) and the benefits of this type of gearbox design.

The construction and operation of the sequential manual gearbox (SMG).

The construction and operation of final drive systems including:

i conventional crown wheel and pinion
ii differential gears
iii limited slip differential

The construction and operation of light vehicle 4 wheel drive systems including third differential and differential locks.

The operation of light vehicle traction control systems and launch control.

**The construction and operation of light vehicle hub arrangements.**

The construction and operation of:

i drive shafts
ii prop shafts including flexible joints and couplings
iii universal joints
iv constant velocity joints
v sliding joints

**Symptoms and faults in light vehicle transmissions and drive-line systems**

Clutch and coupling faults:

i abnormal noises
ii vibrations
iii fluid leaks
iv slip
v judder
vi grab
vii failure to release

Gearbox faults:

i abnormal noises
ii vibrations
iii loss of drive
iv difficulty engaging or disengaging gears
v automatic gear box types
vi abnormal noises
vii vibrations
viii loss of drive
ix failure to engage gear
x failure to disengage gear
xi leaks
xii failure to operate
xiii incorrect shift patterns
xiv electrical and electronic faults
Final drive faults:
  i  abnormal noises
  ii  vibrations
  iii  loss of drive
  iv  oil leaks
  v  failure to operate
  vi  electrical and electronic faults

Drive-lines and couplings:
  i  abnormal noises
  ii  vibrations
  iii  loss of drive

Faults in light vehicle transmission systems
a. Interpret information for diagnostic tests, vehicle and equipment specifications, use of equipment, testing procedures, test plans, fault codes and legal requirements.
b. How to prepare equipment for use in diagnostic testing.
c. How to conduct systematic testing and inspection of transmission system, mechanical, hydraulic, electrical and electronic systems using appropriate tools and equipment including, multimeters, oscilloscope and pressure gauges.
d. How to carry out workshop based and road testing of vehicle and transmission system.
e. Evaluate and interpret test results from diagnostic and/or road testing.
f. Compare test result and values with vehicle manufacturer’s specifications and settings.
g. How to dismantle, components and systems using appropriate equipment and procedures.
h. Assess, examine and evaluate the operation, settings, values, condition and performance of components and systems.
i. Probable faults, malfunctions and incorrect settings.
j. Rectification or replacement procedures.

Operation of systems following diagnosis and repair to confirm operation and performance
Measurements on components to include:
  a.  settings
  b.  input and output values
  c.  voltages
  d.  current consumption
  e.  resistance
  f.  output patterns with oscilloscope
  g.  pressures
  h.  condition
  i.  wear and performance