



**education**

Department:  
Education  
REPUBLIC OF SOUTH AFRICA

# **NATIONAL CERTIFICATES (VOCATIONAL)**

## **SUBJECT GUIDELINES**

### **AUTOMOTIVE REPAIR AND MAINTENANCE**

#### **NQF LEVEL 2**

September 2007



## INTRODUCTION

### **A. What is Automotive Repair and Maintenance?**

Automotive Repair and Maintenance introduces students to the fundamentals of vehicle technology and equips them with the necessary confidence to perform tasks related to, for example, vehicle components, engines, gearboxes, fuel systems, body components and electronics. The tasks are limited to removal, cleaning, servicing (replenishing of fluid) and fitting.

### **B. Why is Automotive Repair and Maintenance important in the Engineering and related Design programme?**

With the necessary knowledge, students will be able to perform tasks and meet requirements set by the industries. Automotive Repair and Maintenance enables students to be more self-reliant and marketable. The subject allows the progression to further qualification and helps students understand terms used in manufacturing and assembly.

### **C. The link between the Automotive Repair and Maintenance Learning Outcomes and the Critical and Developmental Outcomes**

In Automotive Repair and Maintenance, students will identify faults and solve the problems relating to the automotive field. Students will have to work effectively individually or in teams. As students will need to record the requirements to fix faults, they will need communication and writing skills in Automotive Repair and Maintenance.

Automotive Repair and Maintenance also covers two of the Development Outcomes:

- Explore strategies to learn more effectively.
- Explore education and career opportunities.

### **D. Factors that contribute to achieving the Automotive Repair and Maintenance Learning Outcomes**

Students interested in Automotive Repair and Maintenance will benefit because it enables them to work on vehicle basics with related knowledge and use terminology for Automotive Repair and Maintenance correctly.

# **AUTOMOTIVE REPAIR AND MAINTENANCE – LEVEL 2**

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## 1 DURATION AND TUITION TIME

This is a one-year instructional programme comprising 200 teaching and learning hours. The subject may be offered on a part-time basis provided the student meets all the assessment requirements.

Students with special education needs (LSEN) must be catered for in a way that eliminates barriers to learning.

## 2 SUBJECT LEVEL FOCUS

The student should be able to:

- Understand the Fundamentals of Engine Technology
- Balance a Wheel
- Select and Use Vehicle Lifting Equipment
- Carry Out a Service
- Remove, Test, Fit and Service Automobile Batteries
- Inspect and Lubricate an Automotive System
- Adjust Headlights
- Dismantle Vehicle Components
- Remove and Fit Mechanical and Electrical Automobile Components

## 3 ASSESSMENT REQUIREMENTS

### 3.1 Internal assessment (50 percent)

All internal assessments must be finalised by an assessor with at least a certificate of competence.

#### 3.1.1 Theoretical component

The theoretical component forms 40 percent of the internal assessment mark.

Internal assessment of the theoretical component in Automotive Repair and Maintenance Level 2 takes the form of observation, class questions, group work, informal group competitions with rewards, individual discussions with students, class, topic and semester tests and internal examinations. Lecturers can observe students when marking exercises from the previous day and asking class questions.

Assignments, case studies and tests can be completed at the end of a topic. Tests and internal examinations must form part of the internal assessment.

#### 3.1.2 Practical component

The practical component forms 60 percent of the internal assessment mark.

Practical components include applications and exercises. All practical components must be indicated in a Portfolio of Evidence (PoE).

Internal assessment of the practical component in Automotive Repair and Maintenance Level 2 takes the form of assignments, practical exercises, case studies and practical examinations in a workshop environment.

Students may complete practical exercises daily. Assignments and case studies can be completed at the end of a topic. Practical examinations can form part of internal practical assessment.

- **Some examples of practical assessments include, but are not limited to:**

- A. Presentations (lectures, demonstrations, group discussions and activities, practical work, observation, role-play, independent activity, synthesis and evaluation)
- B. Exhibitions by students

- C. Visits undertaken by students based on a structured assignment task
- D. Research
- E. Task performance in a “Structured Environment”

• **Definition of the term “Structured Environment”**

For the purposes of assessment, “Structured Environment” refers to a simulated workplace or workshop environment. Activities in the simulated workplace or environment must be documented in a logbook with a clear listing of the competencies to be assessed. The following information must be contained in the logbook:

- Nature of department or environment in which practical component was achieved
- Learning Outcomes
- Activities in the environment with which to achieve the Learning Outcomes
- Time spent on activities
- Signature of lecturer or supervisor and student

For the logbook to be regarded as valid evidence, it must be signed by an officially assigned supervisor.

• **Evidence in practical assessments**

All evidence pertaining to evaluation of practical work must be reflected in the students’ Portfolio of Evidence (PoE). The tools and instruments constructed and used to conduct these assessments must be clear from the evidence contained in the Portfolio of Evidence (PoE).

3.1.3 Processing of internal assessment mark for the year

A year mark out of 100 is calculated by adding the marks of the theoretical component (40 percent) and the practical component (60 percent) of the internal continuous assessment (ICASS).

3.1.4 Moderation of internal assessment mark

Internal assessment is subjected to internal and external moderation procedures as set out in the *National Examinations Policy for FET College Programmes*.

**3.2 External assessment (50 percent)**

A National Examination is conducted annually in October or November by means of a paper(s) set and moderated externally. A practical component will also be assessed.

External assessment details and procedures are set out in the *Assessment Guidelines: Automotive Repair and Maintenance (Level 2)*.

**4 WEIGHTED VALUES OF TOPICS**

TOPICS	WEIGHTED VALUE
1. Understand the Fundamentals of Engine Technology	14
2. Balance a Wheel	8
3. Select and Use Vehicle Lifting Equipment	6
4. Carry Out a Service	20
5. Remove, Test, Fit and Service Automobile Batteries	8
6. Inspect and Lubricate an Automotive System	10
7. Adjust Headlights	6
8. Dismantle Vehicle Components	14
9. Remove and Fit Mechanical and Electrical Automobile Components	14
<b>TOTAL</b>	<b>100</b>

**5 CALCULATION OF FINAL MARK**

Internal assessment mark: Student’s mark/100 x 50 = a mark out of 50 (a)

Examination mark: Student’s mark/100 x 50 = a mark out of 50 (b)

**Final mark: (a) + (b) = a mark out of 100**

All marks are systematically processed and accurately recorded to be available as hard copy evidence for, amongst others, reporting, moderation and verification purposes.

## 6 PASS REQUIREMENTS

The student must obtain at least fifty (50) percent in ICASS and fifty (50) percent in the examination.

## 7 SUBJECT AND LEARNING OUTCOMES

On the completion of Automotive Repair and Maintenance Level 2, the student should have covered the following topics:

- Topic 1: Understand the Fundamentals of Engine Technology
- Topic 2: Balance a Wheel
- Topic 3: Select and Use Vehicle Lifting Equipment
- Topic 4: Carry Out a Service
- Topic 5: Remove, Test, Fit and Service Automobile Batteries
- Topic 6: Inspect and Lubricate an Automotive System
- Topic 7: Adjust Headlights
- Topic 8: Dismantle Vehicle Components
- Topic 9: Remove and Fit Mechanical and Electrical Automobile Components

### 7.1 Topic 1: Understand the Fundamentals Of Engine Technology

**Subject Outcome 1:** Identify the functions and general locations of motor vehicle systems and components

**Learning Outcomes:**

The student should be able to:

- Identify the position of engine parts in a motor vehicle  
Range: radiator, starter motor, alternator, ignition system, battery, gear box
- Indicate the location of different engine parts in a motor vehicle
- Explain the main functions of engine parts in a motor vehicle

**Subject Outcome 2:** Explain the operation of the internal combustion engine

**Learning Outcomes:**

The student should be able to:

- Understand the process of converting reciprocating motion to rotating motion.
- Identify the four strokes of the internal combustion engine.
- Explain the differences between a petrol engine and a diesel engine.
- Explain the main operation of the two strokes internal combustion engine
- Explain the operation of a rotary engine to understand the four-strokes of this combustion engine

**Subject Outcome 3:** Explain the lubrication system in an internal combustion engine

**Learning Outcomes:**

The student should be able to:

- Describe the main purpose of lubrication in an engine
- Describe the different types of lubrication
- Describe the types of oil pumps for lubrication
- Explain the operation of crankcase ventilation

### 7.2 Topic 2: Balance a Wheel

**Subject Outcome 1:** Plan and prepare work area and vehicle for wheel balancing task.

**Learning Outcomes:**

The student should be able to:

- Obtain, read and interpret task instructions or job card.

- Remove any potential obstacles from the work area.
- Clean the surrounding area.

**Subject Outcome 2:** Prepare wheel balancing machine.

**Learning Outcomes:**

The student should be able to:

- Cleaning the machine.
- Check working conditions of equipment.
- Collect the appropriate tools.
- Arrange the size of balancing weight.
- Load necessary information into computer storage systems

*Range: wheel size, diameter, width, other required information needed*

**Subject Outcome 3:** Balance a wheel.

**Learning Outcomes:**

The student should be able to:

- Interpret and apply information on computer storage systems
- Inspect rims and tyres for damage and wear.
- Mount the wheel on the machine.
- Static balancing of the wheel
- Dynamic balancing of the wheel

**Subject Outcome 4:** Apply safety procedures relating to wheel balancing.

**Learning Outcomes:**

The student should be able to:

- Identify tyre size and inflation
- Adhere to safety rules and regulations.
- Adhere to service and flat rate schedules.

**Subject Outcome 5:** Restore vehicle and work area.

**Learning Outcomes:**

The student should be able to:

- Ensure the vehicle is parked in the demarcated area.
- Raise the vehicle.
- Remove the wheels.

### 7.3 Topic 3: Select and Use Vehicle Lifting Equipment

**Subject Outcome 1:** Discuss and use the basic operation of automobile lifting equipment.

**Learning Outcomes:**

The student should be able to:

- Discuss and use a jack and a hoist.  
*Range: hydraulic jack, two post and four post hoist*
- Operate electrical lifting equipment.
- Operate hydraulic lifting equipment.
- Select correct lifting equipment according to size and weights.

**Subject Outcome 2:** Identify and explain the function of various components related to hoists.

**Learning Outcomes:**

The student should be able to:

- Identify and describe the components of hoists.
- Explain the functions of the components of the hoists.

**Subject Outcome 3:** Carry out precautionary measures before operating a hoist.

**Learning Outcomes:**

The student should be able to:

- Describe the necessary precautions to take before operating a hoist.
- Operate the hoist correctly.
- Operate lifting equipment safely

**Subject Outcome 4:** Operate a hoist a jack a creeper and a safety stand

The student should be able to:

- Work and operate a hoist, a jack and a safety stand according to workshop and manufacturer procedures.

#### 7.4 Topic 4: Carry Out a Service

**Subject Outcome 1:** Plan and prepare for servicing task.

**Learning Outcomes:**

The student should be able to:

- Obtain appropriate fluids, lubricants and parts.
- Obtain appropriate tools and equipment.
- Use the timing light correctly
- Adhere to safety rules and regulations e.g. the Occupational Health and Safety Act (Act 85 of 1993) and company policies and procedures.
- Obtain appropriate personal protective equipment.
- Adhere to service and flat rate schedules.
- Prepare work area and vehicle.
- Carry out a pre-delivery inspection (PDI).
- Inspect the exterior and interior of the vehicle.

**Subject Outcome 2:** Service a vehicle.

**Learning Outcomes:**

The student should be able to:

- Carry out pre-operational checks of vehicle systems and components.
- Carry out a minor service on a motor vehicle.
- Inspect the passenger compartment.
- Inspect the vehicle exterior.
- Inspect the wheels and tyres.
- Inspect the brakes (discs only).
- Inspect the under-body.
- Inspect the engine compartment.
- Service the distributor (for petrol-driven vehicles only).

**Subject Outcome 3:** Perform quality checks after the completed service.

**Learning Outcomes:**

The student should be able to:

- Perform a post-operational check.
- Confirm conformance to the service schedule by visually inspecting the vehicle for any leaks.
- Road test the vehicle.

**Subject Outcome 4:** Restore work area and complete documentation.

**Learning Outcomes:**

The student should be able to:

- Clean the interior and exterior of the vehicle.
- Clean the work area and ensure that all spilt fluids and lubricants have been wiped up and that the surface is dry.
- Dispose of all waste materials, fluids, lubricants, filters and other rubbish according to safety, health and environmental procedures.
- Clean all tools and equipment that were used and store them in their appropriate storage area according to company procedures.

**Subject Outcome 5:** Discuss and explain reasons for servicing vehicles.

**Learning Outcomes:**

The student should be able to:

- Compile a report detailing all activities performed during the service.
- Include the readings of any leaks and defects that were identified during the inspection.
- Complete and submit the job card and checklist with the report to the appropriate personnel for costing.

## 7.5 Topic 5: Remove, Test, Fit and Service Automobile Batteries

**Subject Outcome 1:** Explain, discuss and demonstrate the removal and fitting of an automobile battery.

**Learning Outcomes:**

The student should be able to:

- Understand basic electricity.
- Identify electrical symbols and circuits.
- Understand magnetism.
- Understand induced electricity.
- Understand laws relating to basic electricity.
- Understand legislation and documentation concerning the battery.

**Subject Outcome 2:** Test automobile batteries.

**Learning Outcomes:**

The student should be able to:

- Perform a visual inspection on a battery.
- Perform a battery leakage test.
- Perform a battery terminal test.
- Perform a battery voltage test.
- Test the battery with a hydrometer.
- Load test a battery (battery capacity test).
- Perform a three-minute charge test (sulphation test).
- Perform voltage drop tests.

**Subject Outcome 3:** Service automobile batteries.

**Learning Outcomes:**

The student should be able to:

- Prepare for work activity.
- Perform the battery charging procedure.

**Subject Outcome 4:** Discuss and explain automobile battery-related topics

**Learning Outcomes:**

The student should be able to:

- Order new batteries.
- Clean and store tools, equipment and chemicals.
- Identify different types of batteries
- Identify battery components
- Describe battery accessories
- Identify and describe different battery ratings
- Explain influence of temperature on battery efficiency
- Identify specific gravity of electrolyte
- Describe electrolysis or chemical process
- Perform battery discharging
- Perform battery recharging
- Perform battery charging

**Subject Outcome 5:** Use and complete relevant documentation.

**Learning Outcomes:**

The student should be able to:

- Issue battery warranty documentation. This serves to indicate the warranty period and conditions. In some cases, instead of issuing a warranty document, a receipt is used and a serial number is stamped onto the battery. This serial number contains the date and place of purchase and it can be referenced for warranty purposes.

**7.6 Topic 6: Inspect and Lubricate an Automotive System**

**Subject Outcome 1:** Discuss and explain reasons and purpose for lubrication.

**Learning Outcomes:**

The student should be able to:

- Adhere to service and flat rate schedules.
- Understand applicable lubrication theory.
- Understand the different types of fluid and lubricant.
- Understand the fundamentals of lubrication.
- Understand the names and functions of vehicle components and systems involved in a fluid or lubrication service.
- Explain the relationship between preventative maintenance and the operational condition of vehicle

**Subject Outcome 2:** Plan and prepare to inspect and lubricate the vehicle

**Learning Outcomes:**

The student should be able to:

- Obtain, read and interpret task instructions or job card and lubrication checklist.
- Obtain specified fluids and lubricants.
- Obtain appropriate tools and equipment.
- Adhere to safety rules and regulations.
- Prepare the work area.
- Adhere to service and flat rate schedules.

**Subject Outcome 3:** Drain, refill or top up fluids and apply lubricants.

**Learning Outcomes:**

The student should be able to:

- Inspect vehicle's fluid levels.
- Change engine oil and filter.
- Change automatic transmission fluid and filter.
- Inspect a vehicle for and locate fluid leaks and defects.
- Apply lubricants or grease to lubrication or grease points.

**Subject Outcome 4:** Identify and inspect leaks and defects.

**Learning Outcomes:**

The student should be able to:

- Inspect briefly the under-body, paying particular attention to the common areas where leaks occur.  
*Range: The sump, clutch housing, steering gearbox, dampers and drive shafts*
- Look for leaks upwards and forwards from where the fluid is found.

**Subject Outcome 5:** Restore work area.

**Learning Outcomes:**

The student should be able to:

- Clean the work area and ensure that all spilt fluids and lubricants have been wiped up and that the surface is dry.
- Dispose of all waste materials, fluids, lubricants, filters and other rubbish according to safety, health and environmental procedures. Usually, designated disposal areas are provided for hazardous goods.
- Clean all tools and equipment that were used and store them in their appropriate storage area according to company procedures.

**Subject Outcome 6:** Complete and process documentation.

**Learning Outcomes:**

The student should be able to:

- Compile a report detailing all activities performed during the lubrication service.
- Include any leaks and defects that were found during the inspection.
- Complete and submit the job card and checklist with the report to the appropriate personnel for costing.

### 7.7 Topic 7: Adjust Headlights

**Subject Outcome 1:** Plan for the adjusting of the headlights.

**Learning Outcomes:**

The student should be able to:

- Obtain task instructions or job card and relevant specifications.
- Name the headlight components and explain their functions.
- Adjust headlights according to workshop manual procedures.

**Subject Outcome 2:** Prepare the vehicle and headlight aimer.

**Learning Outcomes:**

The student should be able to:

- Prepare the worksite and vehicle for work activity.
- Ensure that appropriate tools, testing equipment and consumables are at the workstation.
- Workshop or service manuals
- Beam setting equipment

**Subject Outcome 3:** Adjust the headlights.

**Learning Outcomes:**

The student should be able to:

- Remove and replace a sealed beam.
- Remove and replace a headlight bulb.
- Remove and replace a rear light assembly.
- Remove and replace a numberplate light(s).
- Remove and replace a front fog lamp.

**Subject Outcome 4:** Restore the work area.

**Learning Outcomes:**

The student should be able to:

- Clean and pack away all the tools used.
- Store equipment in the correct place.
- Clean the work area and ensure that surfaces are dry.

**Subject Outcome 5:** Complete and process documentation.

**Learning Outcomes:**

The student should be able to:

- Write a report detailing and justifying the activities performed.
- Submit the report to the relevant personnel for verification.

### 7.8 Topic 8: Dismantle Vehicle Components

**Subject Outcome 1:** Plan the procedure for dismantling and prepare the component and workplace.

**Learning Outcomes:**

The student should be able to:

- Obtain, read and interpret task instructions.
- Determine sequence of operations.
- Be aware of service flat rate schedules and time.
- Identify and obtain appropriate tools and equipment allocations.

- Adhere to safety rules and regulations.
- Prepare the work area.
- Prepare the components for dismantling.

**Subject Outcome 2:** Dismantle component and prepare for inspection and evaluation.

**Learning Outcomes:**

The student should be able to:

- Prepare the engine components for dismantling.
- Dismantle the vehicle components.
- Prepare parts for inspection and evaluation.
- Process identified serviceable and non-serviceable parts.

**Subject Outcome 3:** Discuss and explain procedures followed for dismantling components.

**Learning Outcome:**

The student should be able to:

- Identify the names and functions of vehicle components.

## 7.9 Topic 9: Remove and Fit Mechanical and Electrical Automobile Components

**Subject Outcome 1:** Identify mechanical and electrical components to be removed or fitted.

**Learning Outcomes:**

The student should be able to:

- Understand basic auto-electrical theory.
- Understand basic auto-electrical circuits and symbols.
- Plan and prepare to build an auto-electrical circuit.

**Subject Outcome 2:** Select and use correct tools for fitting and removing automobile components.

**Learning Outcomes:**

The student should be able to:

- Obtain and complete relevant documentation for components to be removed and fitted.
- Identify, obtain and use appropriate tools, equipment, fasteners, locking devices and strapping.
- Adhere to safety rules and regulations.
- Remove and fit mechanical and electrical automobile components.

**Subject Outcome 3:** Select and use fasteners, locking devices and strapping.

**Learning Outcome:**

The student should be able to:

- Select and use fasteners, locking devices and strapping correctly.

**Subject Outcome 4:** Remove and fit automobile components.

**Learning Outcomes:**

The student should be able to:

- Remove the starter motor.
- Remove and replace the solenoid from the starter motor.
- Replace the starter motor.
- Remove and replace the alternator.
- Remove and replace the radiator.
- Remove and fit a serviceable fuel pump.
- Remove and replace a turbo-charger.
- Remove and replace a diesel fuel injection pump.
- Remove and replace the ignition coil.
- Remove and replace an electric window lifter and door lock.
- Remove a front and rear wiper motor and linkage.
- Remove and replace a windscreen washer and pump.
- Fit front and rear speakers.

- Remove and replace an interior fan.

**Subject Outcome 5:** Test fitted and associated mechanical and electrical automobile components.

**Learning Outcomes:**

The student should be able to:

- Visually inspect all the components, once fitted, for correct alignment and damage.
- Test the components according to the manufacturer's requirements to ensure proper functionality of the components.

**Subject Outcome 6:** Use and complete relevant documentation.

**Learning Outcomes:**

The student should be able to:

- Restore the work area and complete relevant documentation.

## **8 RESOURCE NEEDS FOR THE TEACHING OF AUTOMOTIVE REPAIR AND MAINTENANCE – LEVEL 2**

### **8.1 Physical resources**

The following teaching aids should be made available, if possible:

#### **8.1.1 Practicum room**

- A simulated workshop environment, provided with basic tools and workshop equipment
- Necessary electronic equipment, e.g. training models, television with video or DVD player, computer and printer
- Internet access

#### **8.1.2 Technology and research centre**

- Availability of computers and printers for students to complete assignments or case studies and do research
- Research software, for example Encarta
- Subject related magazines (Motor Vehicle Technology; Auto Data Book & Technique, etc.), newspapers related to subject and subject-related reference books
- Subject-related DVDs and videos
- List of stakeholders prepared to be involved in the learning process through presentations or providing the opportunity for students to gain practical experience
- Applicable legislation or acts for use by lecturers during lessons and students for research purposes
- Stock room to store video or DVD machines, televisions, etc.
- Security for stockroom, media centre and practicum room

#### **8.1.3 Classroom**

- Computer and data projector or latest technology to electronically project data for students
- Flash disk for lecturer to store information
- Presentation program on computer to be used by lecturer to provide students with visual information on Learning Outcomes
- White board, black board and pull-down screen
- Desks for students big enough to work on

### **8.2 Human resources**

- The lecturer must have an applicable subject-related qualification at NQF Level 5.
- It would be an advantage if the lecturer has already been declared competent as an assessor and/or moderator.
- The lecturer should be trained in outcomes-based education.

### **8.3 Other resources**

- Text books

- Answer books, with examples which students must complete for practical assignments
- Calculator for each student
- Lever arch file for each student to serve as Portfolio of Evidence (PoE)