basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MECHANICAL TECHNOLOGY (AUTOMOTIVE)

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 12

2023

These guidelines consist of 42 pages.

TABLE OF CONTENTS

1. INTRODUCTION/BACKGROUND

The 18 Curriculum and Assessment Policy Statement subjects which contain a practical component all include a practical assessment task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- SCIENCES: Computer Applications Technology, Information Technology, Technical Sciences, Technical Mathematics
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: **Mechanical Technology**, Civil Technology, Electrical Technology, and Engineering Graphics and Design

A practical assessment task (PAT) mark is a compulsory component of the final promotion mark for all candidates offering subjects that have a practical component and counts 25% (100 marks) of the end-of-year examination mark. The PAT is implemented across the first three terms of the school year. This is broken down into different tasks or a series of smaller activities that make up the PAT. The PAT allows for candidate to be assessed on a regular basis during the school year and it also allows for the assessment of skills that cannot be assessed in a written format, e.g. test or examination. It is therefore important that schools ensure that all candidates complete the practical assessment tasks within the stipulated period to ensure that candidate are resulted at the end of the school year. The planning and execution of the PAT differs from subject to subject.

The PAT allows the teacher to observe applied competence directly and systematically. The PAT comprises the application/performance of the knowledge, skills, and values particular to that subject and counts 25% of the total promotion/certification mark out of 400 for the subject.

The PAT is implemented across the first three terms of the school year.

Any profession requires of its members a thorough grounding in both theory and practice, and MECHANICAL TECHNOLOGY is no exception. It is emphasised that the goal of the practical assessment task is to produce a skilled candidate in each specialisation field. A nation's true wealth is in its manpower and education that should aim to develop the talents of a candidate so that he/she can contribute to the well-being of the society by using and developing scientific and technological resources.

To prepare a candidate in MECHANICAL TECHNOLOGY'S specialisation fields, one must focus on the following:

- An attitude where the candidate can selectively use ideas, gather evidence and facts and draw logical conclusions to put them to good use creatively and with imagination;
- A capability to express ideas and information clearly by speech, writing, drawing and manufacturing and
- A willingness and capability to accept and exercise responsibility, to make decisions, and to learn by experience.

Attributes such as these cannot all be achieved in a classroom. A sound knowledge of engineering sciences is essential to equip the MECHANICAL TECHNOLOGY candidate with the necessary practical capabilities for the required processes. Practical training is the application of acquiring essential skills to bridge between trade theory and practice.

Practical application in the workshop must therefore be made an interesting and challenging experience to develop the candidates physically and mentally. The candidates must show his/her initiative, curiosity, and persistence in learning. In order to stimulate and develop self-confidence the granting of some degree of responsibility during the practical application is very important.

2. TEACHER GUIDELINES

2.1 Administration of the PAT

Teachers are requested to make copies of the different specialisation PAT documents. These documents need to be handed out to the candidates at the beginning of the year. The practical assessment task for Grade 12 is externally set, internally assessed and externally moderated.

Teachers must attach due dates for the different facets of the PAT *(refer to the CAPS document)*. In this manner, candidates can easily assess their progress. Where formal assessments take place, it is the responsibility of the teacher to administer assessment.

The PAT should be completed within the first three terms. The PAT should be completed under controlled conditions *(refer to Mechanical Technology SPECIALISATION: CAPS Grade 10–12)*.

Teachers MUST compile the manufacturer's specifications of the engines and vehicles available in their workshops before the tasks can commence. See ANNEXURE A as an example of a specification sheet. Candidates must have access to these specification sheets during the tasks. **Teachers must perform all the tasks prior to assessing candidates so that they can identify possible challenges and the final results**. It provides the teacher with insight into possible challenges regarding equipment or tools and what possible procedures he/she needs to follow in the workshop in order to complete the PAT.

NOTE: The candidate must complete the test procedures practically, without the worksheet in hand, while the teacher assesses the procedure according to the marking guidelines. After the procedure has been completed, the worksheet is handed to the candidate to complete the reasons, readings etc.
TASK 6: The candidate must be provided with WORKSHEET 6.2 during the assessment as the candidate has to record his/her own measurements and perform the necessary calculations.

2.2 Assessment of PAT

Frequent and developmental feedback is needed to ensure the necessary guidance and support to the candidates.

Both formal and informal assessment should be conducted to ensure that the embedded skills are developed. Informal assessment can be conducted only to monitor the progress of the candidates. Formal assessment should always be conducted and recorded by the teachers.

On completion of each task in each term, the marks for the completed task need to be recorded on the school administration system.

2.3 Moderation of PAT

The tasks, projects, assessment criteria and the mark sheets must be presented to the moderator during moderation of the PAT.

The moderator should be able to call on a candidate to explain and demonstrate the functions, principles and skills during the moderation.

On completion, the moderator will, if necessary, adjust the marks of the group upwards or downwards depending on the decision reached as a result of moderation.

Tasks must be clearly marked with the correct date, initials, surname and signature of each candidate.

2.4 Consequences of absence/non-submission of tasks.

If a candidate's practical assessment task is incomplete or unavailable with a valid reason, the candidate may be given three weeks before the commencement of the final end-of-year examination to submit the outstanding task. Should the candidate fail to fulfil the outstanding PAT requirement, such a candidate will be awarded a zero mark for that PAT component.

A candidate's results are regarded as incomplete if the candidate did not submit any one of the PAT tasks. Based on the decision of the head of the assessment body, the candidate will be given another opportunity. Should the candidate fail to fulfil the outstanding PAT requirement, the marks for this task will be omitted and the final mark for Mechanical Technology will be adjusted for promotion purposes in terms of the completed tasks. If any tasks are still outstanding, the candidate runs the risk of not being resulted at the end of the year.

2.5 Declaration of Authenticity

NAME OF THE SCHOOL:

_____

NAME OF CANDIDATE:

_____
(FULL NAME(S) AND SURNAME)

NAME OF TEACHER:

_____

I hereby declare that the tasks submitted for assessment are my own, original work and has not been previously submitted for moderation.

_____ _____
SIGNATURE OF CANDIDATE DATE

As far as I know, the above declaration by the candidate is true and I accept that the work offered is his or her own.

_____ _____
SIGNATURE OF TEACHER DATE

SCHOOL STAMP

3. CANDIDATES' GUIDELINES

Instructions to the candidates

- The practical assessment task (PAT) consists of a compulsory task in **Automotive**. The compulsory task could be completed during any of the three terms, as set out in this document. *(Also see CAPS document)*
- All tasks must be completed according to the time frames as set out in this document.
- Candidates are to actively engage in all practical assessment tasks.
- Candidates who are uncooperative will receive demerits or a zero mark for that particular section of the work.
- Candidates who act unsafely in the workshop and place other candidates in danger, will be given additional corrective measures to improve their safety awareness.
- Your tasks must be completed fully by end of August 2023 in order to be ready for provincial and national moderation.
- Your worksheets need to be **clearly marked** with your name, surname, signature and date of assessment.
- At least one task must be completed each term. The compulsory task must be completed during Term 1, 2 or 3.
- The candidate must be present and available to explain and demonstrate the functions, principles and skills during the moderation.

4. SPECIALISATION: AUTOMOTIVE

Term: 1 to 3
Starting date: January 2023
Completion date: August 2023

INTRODUCTION

This section comprises SEVEN practical tasks:

TASK 1: Cylinder compression and leakage tests is a **COMPULSORY** task.

Choose any THREE tasks from the remaining SIX tasks (TASKS 2–7), namely:

TASK 2: Gas analysing
TASK 3: Wheel balancing
TASK 4: Charging system
TASK 5: Fuel pressure test
TASK 6: Engine components measurement and calculations
TASK 7: Computerised diagnostic scanner

NOTE: Number of tasks = 4 (1 + 3)

The teacher must explain and demonstrate the knowledge and skills that will be assessed during these tasks. Due dates for the completion of the tasks should also be communicated to the candidates.

Activity outcome

- Candidates apply theoretical knowledge in practice with regard to:
  - Safety, tools, maintenance and systems and control
  - Correct use of tools and equipment
  - Use equipment to diagnose faults in the engine
- These tasks must be done under the supervision of the teacher and the candidates should be assessed while performing these tasks.

TASK 1 (COMPULSORY)

TASK 1: CYLINDER COMPRESSION AND LEAKAGE TESTS

- **WORKSHEET 1.1 – Cylinder compression and leakage tests – Questions**
  - Answer the questions on WORKSHEET 1.1.

- **WORKSHEET 1.2 – Cylinder compression test – Procedure**
  - Perform the tasks on WORKSHEET 1.2.
  - Record the findings and conclusions on WORKSHEET 1.2.
  - Use the specification manual to obtain specifications for the engine used to conduct the compression tests and record the findings on ANNEXURE A.

- **WORKSHEET 1.3 – Cylinder leakage test – Procedure**
  - Perform a cylinder leakage test on a four-cylinder, four-stroke petrol engine.
  - Record the findings and conclusions on WORKSHEET 1.3.

TASK 2: GAS ANALYSING

- **WORKSHEET 2.1 – Gas analysing – Questions**
  - Answer the questions on WORKSHEET 2.1.

- **WORKSHEET 2.2 – Gas analysing – Procedure**
  - Perform the tasks on WORKSHEET 2.2.
  - Use the specification manual to obtain readings for the engine used to conduct the gas analysis test and record the findings on ANNEXURE A.

TASK 3: WHEEL BALANCING

- **WORKSHEET 3.1 – Wheel balancing – Questions**
  - Answer the questions on WORKSHEET 3.1.

- **WORKSHEET 3.2 – Wheel balancing – Procedure**
  - Perform the tasks on WORKSHEET 3.2.
  - Use a wheel balancing machine to balance a wheel.

TASK 4: CHARGING SYSTEM

- **WORKSHEET 4 – Charging system – Procedure**
  - Identify the components of the alternator.
  - Perform the charging system test procedures on a vehicle.
  - Test the alternator components on WORKSHEET 4.

TASK 5: FUEL PRESSURE TEST

- **WORKSHEET 5.1 – Fuel pressure test – Questions**
  - Answer the questions on WORKSHEET 5.1.

- **WORKSHEET 5.2 – Fuel pressure test – Procedure**
  - Perform the fuel pressure test procedures on a fuel system.
  - Record the findings on WORKSHEET 5.2.

TASK 6: ENGINE COMPONENTS MEASUREMENT AND CALCULATIONS

- **WORKSHEET 6.1 – Engine components measurement and calculations – Questions**
  - Answer the questions on WORKSHEET 6.1.

- **WORKSHEET 6.2 – Engine components measurement and calculations – Procedure**
  - Perform the engine components measurement procedures on an engine.
  - Record the findings on WORKSHEET 6.2.

TASK 7: COMPUTERISED DIAGNOSTIC SCANNER

- **WORKSHEET 7.1 – Computerised diagnostic scanner – Questions**
  - Answer the questions on WORKSHEET 7.1.

- **WORKSHEET 7.2 – Computerised diagnostic scanner – Procedure**
  - Perform the computerised diagnostic scanning procedures on a vehicle and record the findings on WORKSHEET 7.2.

THE FOLLOWING TASK IS COMPULSORY

TASK 1: CYLINDER COMPRESSION AND LEAKAGE TESTS (COMPULSORY)

WORKSHEET 1.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS		MARK
1.1.1. Tabulate THREE differences between the *cylinder compression test* and the *cylinder leakage test*.		6
Cylinder compression test	**Cylinder leakage test**	
1.1.2. Describe FOUR precautions and the reasons why they must be adhered to, when conducting the compression test.		8
Precaution	**Reason**	

1.1.3.	State FOUR causes of low compression in an engine.	4
1.1.4.	State THREE faults that can develop due to low compression in an engine.	3
1.1.5.	Explain the meaning of the expression *engine compression*.	2
1.1.6.	Name TWO compression tests that can be done on an internal combustion engine.	2
1.1.7.	After which compression test could the reading be higher?	1
1.1.8.	Give TWO reasons for a higher compression reading in QUESTION 1.1.7.	2
	TOTAL – Cylinder compression and leakage tests – Questions	**28**

TASK 1: COMPRESSION TEST

WORKSHEET 1.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

DRY COMPRESSION TEST				
1.2.1 Conduct a dry compression test.				
PROCEDURE			**MARK**	**TOTAL**
(a)	Obtain the compression pressure specification.		1	
(b)	Test the battery voltage.	TWO REASONS: 	3	
(c)	Start the engine.		1	
(d)	Check if engine is at operating temperature.	REASON: 	2	
(e)	Switch off the engine.		1	
(f)	Number the spark plug HT leads according to the cylinder.		1	
(g)	Remove the spark plug HT leads.		1	
(h)	Clean around the spark plugs before removing them.	REASON: 	2	
(i)	Remove the spark plugs.		4	
(j)	Remove the air filter.	REASON: 	2	
(k)	Disable the ignition system; if not, remove HT lead from coil.		1	
(l)	Disconnect the fuel supply.		1	
(m)	Fit the compression tester to the cylinder.		4	
(n)	Fully open the throttle valve.		4	
(o)	Crank engine to perform tests for each cylinder.		4	
(p)	Record the readings.	1. 2. 3. 4.	4	
(q)	Compare the readings.	REASON: 	2	
		TOTAL – Dry compression test – Procedure	**38**	

WET COMPRESSION TEST				
1.2.2	Conduct a wet compression test on the cylinder with the lowest reading.			
	PROCEDURE		**MARK**	**TOTAL**
(a)	Squirt oil into cylinder onto the piston.		1	
(b)	Connect compression tester.		1	
(c)	Open the throttle valve fully.		1	
(d)	Crank the engine 4 to 10 times.		1	
(e)	Record the reading.		1	
(f)	Conclusions after the wet compression test.	CONCLUSION:	2	
(g)	Fit spark plugs (initially turn plugs in by hand).		4	
(h)	Reconnect electrical connections and HT leads.		2	
(i)	Reconnect fuel supply.		1	
	TOTAL – Wet compression test – Procedure		**14**	

TOTAL – Dry compression test – Procedure	38	
TOTAL – Wet compression test – Procedure	14	
TOTAL – Compression tests	**52**	

TASK 1: CYLINDER LEAKAGE TEST

WORKSHEET 1.3 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

CYLINDER LEAKAGE TEST			
1.3	Perform a cylinder leakage test on one cylinder.		
PROCEDURE		**MARK**	**TOTAL**
1.3.1	Turn engine clockwise at the crankshaft pulley.	1	
1.3.2	Turn engine until piston is at TDC on compression stroke. REASON:	2	
1.3.3	Lock the crankshaft. REASON	2	
1.3.4	Screw the spark plug hose adapter into the spark plug hole.	1	
1.3.5	Connect the leakage tester to the compressor.	1	
1.3.6	Calibrate the leakage tester. REASON:	2	
1.3.7	Connect leakage tester to spark plug hole adapter.	1	
1.3.8	Read the percentage leakage. CONCLUSION:	2	
1.3.9	Check for cause(s) of leakage(s) (irrespective of the engine condition). FOUR CAUSES AND REASONS:	8	
	TOTAL – Cylinder leakage test – Procedure	**20**	

CYLINDER COMPRESSION AND LEAKAGE TESTS MARKS SUMMARY	MARK	TOTAL
TOTAL – Cylinder compression and leakage tests – Questions	28	
TOTAL – Cylinder compression test – Procedure	52	
TOTAL – Cylinder leakage test – Procedure	20	
GRAND TOTAL	**100**	

SIGNATURE OF CANDIDATE:		**DATE:**	

TASK 2: GAS ANALYSING

WORKSHEET 2.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS		MARK
2.1.1	What is the purpose of using a gas analyser on an internal combustion engine?	2
2.1.2	State TWO faults that would prompt you to analyse the exhaust gases of an internal combustion engine.	2
2.1.3	Name FIVE gases that can be analysed by the exhaust gas analyser.	5
2.1.4	State FOUR safety precautions that must be adhered to when conducting the exhaust gas analysis.	4
2.1.5	State FOUR causes of improper and/or incomplete combustion.	4
2.1.6	What is the ideal air-fuel ratio for a spark ignition engine?	1
	TOTAL – Gas analysing – Questions **18**	

TASK 2: GAS ANALYSING

WORKSHEET 2.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

EXHAUST GAS ANALYSIS			
2.2 Conduct an exhaust gas analysis on an internal combustion engine following the correct sequence.			
PROCEDURE		**MARK**	**TOTAL**
2.2.1 Obtain the following manufacturers' exhaust gas specifications of the engine to be tested:		3	
• Oxygen (O_2)			
• Carbon monoxide (CO)			
• Carbon dioxide (CO_2)			
2.2.2 Ensure proper ventilation during the test.	REASON:	2	
2.2.3 Bring the engine to operating temperature.	REASON:	2	
2.2.4 Ensure filters on analyser are clean.		1	
2.2.5 Check for any exhaust gas leaks.	THREE REASONS:	3	
2.2.6 Check for any vacuum leaks.	REASON:	2	
2.2.7 Switch on the analyser (connect cables to battery terminals or use switch).	REASON:	2	
2.2.8 Calibrate the gas analyser.	REASON:	2	
2.2.9 Ensure that the inlet hose is not restricted.		1	
2.2.10 Insert probe into exhaust pipe.		1	

2.2.11 Take the readings of the exhaust gases. **(Choose any TWO of the following three gases – CO, O_2 or CO_2)**			
(a) **CO% result obtained**		1	
Compare CO% reading with specifications.	CONCLUSION:	4	
(b) **O_2% result obtained**		1	
Compare O_2 reading with specifications.	CONCLUSION:	4	
(c) **CO_2% result obtained**		1	
Compare CO_2 reading with specifications.	CONCLUSION:	4	
2.2.12 Disconnect the analyser.		1	
2.2.13 Remove the probe from the exhaust pipe.		1	
2.2.14 Remove condensate from pipes.		1	
TOTAL – Gas analysing – Procedure		**32**	

TOTAL – Gas analysing – Questions	18	
TOTAL – Gas analysing – Procedure	32	
GRAND TOTAL	**50**	

SIGNATURE OF CANDIDATE:		**DATE:**	

TASK 3: WHEEL BALANCING

WORKSHEET 3.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS	MARK
3.1.1. State FOUR advantages of having the motor vehicle's wheels balanced.	4
3.1.2. Why is it necessary for the wheel balancing machine to be correctly calibrated?	1
3.1.3. State THREE functions of the wheel-weight hammer.	3
3.1.4. Define *static balance* of a wheel and tyre assembly.	2
3.1.5. Define *dynamic balance* of a wheel and tyre assembly.	2

3.1.6	FIGURE 3.1.6 shows different tyre conditions. State the cause of each condition (A–C).	**A**	**B**	**C**
				
		FIGURE 3.1.6		
		A –		
		B –		
		C –		
3.1.7	State FOUR safety measures that should be observed when performing wheel balancing.			
		TOTAL – Wheel balancing – Questions	**19**	

TASK 3: WHEEL BALANCING

WORKSHEET 3.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

WHEEL BALANCING			
3.2 Balance a wheel and tyre assembly using the correct procedure.			
PROCEDURE		**MARK**	**TOTAL**
3.2.1. Choose the correct rim adapter for the rim size to mount the wheel		1	
3.2.2. Fit wheel to the wheel balancer correctly.		1	
3.2.3. Check the tyre for uneven wear.		1	
3.2.4. Check the tyre for bruises, cracks and damaged side walls.		1	
3.2.5. Check tyre wear level at the tyre wear indicators (TWI).		1	
3.2.6. Remove foreign matter from the rim and tyre.		1	
3.2.7. Check the wheel rim for any damages.		1	
3.2.8. Obtain the wheel rim diameter from the tyre.		1	
3.2.9. Enter wheel rim diameter into the wheel balancer.		1	
3.2.10. Obtain tyre pressure specification.		1	
3.2.11. Check tyre pressure.		1	
3.2.12. Use the calliper to determine the rim width.		1	
3.2.13. Enter wheel rim width into the wheel balancer		1	
3.2.14. Use the off-set arm to measure the distance to the wheel		1	
3.2.15. Enter off-set measurement into the wheel balancer		1	
3.2.16. Close safety cover.		1	
3.2.17. Start the wheel balancer and allow wheel to spin		1	
3.2.18. Obtain the imbalance readings on the outer and inner part of the rim. Inner reading: _____ Outer reading: _____	REASON:	3	

3.2.19. Remove wheel weights.	1	
3.2.20. Close safety cover.	1	
3.2.21. Start the balancer to determine the imbalance readings.	1	
3.2.22. Obtain the magnitudes and locations of the imbalance readings on the rim. Inner reading: _____ Outer reading: _____	2	
3.2.23. Choose the appropriate weights.	2	
3.2.24. Fit the weights correctly onto the rim.	2	
3.2.25. Re-check balancing.	1	
3.2.26. Remove wheel if balanced.	1	
TOTAL – Wheel Balancing – Procedure	**31**	

TOTAL – Wheel balancing – Question	19	
TOTAL – Wheel balancing – Procedure	31	
GRAND TOTAL	**50**	

SIGNATURE OF CANDIDATE:		**DATE:**	

TASK 4: CHARGING SYSTEM

WORKSHEET 4 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

4. Perform the following tasks regarding the charging system.

CHARGING SYSTEM (ALTERNATOR)	**MARK**	**TOTAL**
4.1 Identify any SEVEN components (A–I) of the alternator in FIGURE 4.1	7	

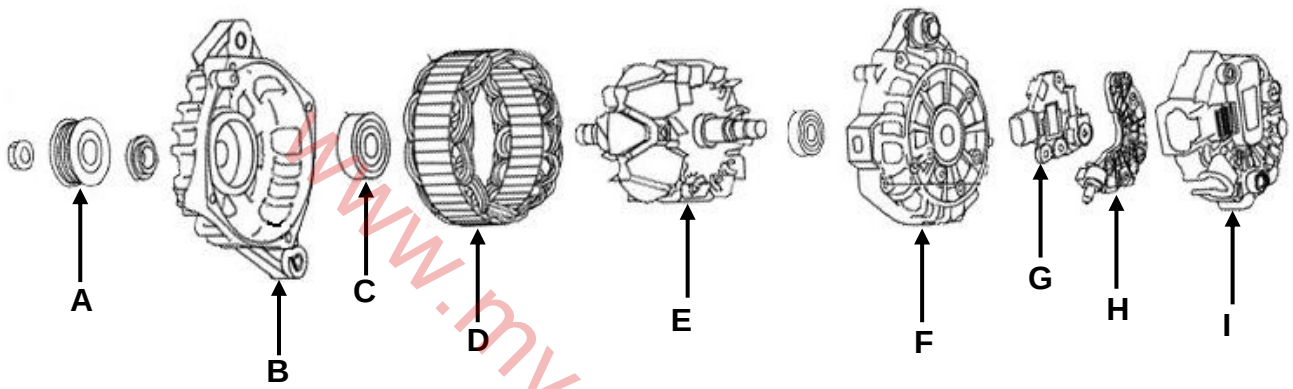

FIGURE 4.1

A -	F -	
B -	G -	
C -	H -	
D -	I -	
E -		

4.2 Test the charging system on a vehicle.

PROCEDURE		**MARK**	**TOTAL**
4.2.1 Select DC voltage on the multimeter.		1	
4.2.2 Obtain the manufacturer's specifications for the vehicle's charging system	• Voltage at idling • Voltage with load	2	
4.2.3 Check for loose electrical connections	• Terminals or frayed wires	1	
4.2.4 Check the alternator belt	• Tension • Condition	2	
4.2.5 Use multimeter to measure the battery voltage of vehicle at idling.	• At least 13,8 volts – good	2	
4.2.6 Measure battery voltage with load.	• Switch on accessories including lights, HVAC, etc.	2	
4.2.7 Report on voltage drop at idling speed, with and without load.	• Acceptable if drop is 5 V and below.	2	
TOTAL – Charging System – Procedure		**19**	

4.3 Test the following components of a dismantled alternator.			
PROCEDURE		**MARK**	**TOTAL**
4.3.1 Select continuity (buzzer) on the multimeter		1	
Check the six diodes on rectifier.			
4.3.2 Connect the multimeter to both sides of the diodes.		6	
4.3.3 Report on condition of diodes.		6	
Check stator for continuity.			
• Connect the multimeter to a different pair of each of the three winding ends respectively.		3	
4.3.4 Report on continuity of stator windings	REPORT:	3	
Check stator for earth leakage.			
4.3.5 Connect the multimeter to the stator framework and the other end to any of the three windings ends.		1	
4.3.6 Report on earth leakage of stator windings.	REPORT:	1	
Check rotor for continuity.			
4.3.7 Connect multimeter to both slip rings.		1	
4.3.8 Report on continuity of rotor windings.	REPORT:	1	
4.3.9 Check if slip rings are connected properly to rotor windings.		2	
4.3.10 Check slip rings for wear.		1	
Check rotor for earth leakage.			
4.3.11 Connect multimeter to rotor winding and rotor framework (poles).		1	
4.3.12 Report on earth leakage of rotor windings.	REPORT:	1	
4.3.13 End bracket/Cover for wear.		1	
4.3.14 Check front bearing and rear bearing.		2	
TOTAL – Alternator testing – Procedure		**31**	

TOTAL – Charging system – Procedure	19	
TOTAL – Alternator testing – Procedure	31	
GRAND TOTAL	**50**	

SIGNATURE OF CANDIDATE:		**DATE:**	

TASK 5: FUEL PRESSURE TEST

WORKSHEET 5.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS	MARK
5.1.1 State the function of the fuel pressure tester.	2
5.1.2 Name TWO methods by which fuel pumps are driven on an internal combustion engine.	2
5.1.3 State the function of a fuel filter.	1
5.1.4 State TWO functions of a check valve in the fuel system.	2
5.1.5 State THREE possible faults and their corrective measures for low fuel pressure.	6

FAULT	CORRECTIVE MEASURE

TOTAL – Fuel pressure test – Questions	**13**	

TASK 5: FUEL PRESSURE TEST

WORKSHEET 5.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

5.2 Conduct the fuel pressure test in the correct sequence.				
PROCEDURE			**MARK**	**TOTAL**
5.2.1	Obtain the fuel pressure specifications:		3	
	• After the injector pump or fuel pump			
	• When the engine is idling			
	• At high revolutions			
5.2.2	Work in a well-ventilated area.		1	
5.2.3	Ensure there is fire extinguisher nearby.		1	
5.2.4	Obtain the correct adaptor in accordance with the hose size.		1	
5.2.5	Ensure that the tester can read the pressure of the fuel system.		1	
5.2.6	Ensure that the rubber hose on the tester has not perished.		1	
5.2.7	Ensure that the tester's pressure relieve valve is working properly.		1	
5.2.8	Fit fuel pressure tester to fuel line between the pump and engine.	• Release the pressure safely. • Insert the T-piece in the fuel line • Secure the T-piece in the fuel line **OR** • Locate the Schrader type valve on the fuel rail. • Connect tester to the Schrader type valve on the fuel rail.	3	
5.2.9	Switch ignition on until maximum fuel pressure is reached.		1	
5.2.10	Switch ignition off after the full pressure is reached.		1	
5.2.11	Check fuel pressure on gauge	REPORT:	3	
5.2.12	Release pressure and connect to fuel hose on engine side as well.		2	
5.2.13	Switching ignition on and then off after the full pressure is reached.	• Check for leaks	2	
5.2.14	Check fuel pressure on gauge.	• If pressure drops, then there is a leak in the engine.	2	
5.2.15	Check regulator vacuum hose for wetness.	• If wet, regulator valve is leaking	2	
5.2.16	Check for leaking injectors.	1. 2. 3. 4.	4	
TOTAL – Fuel pressure test – Procedure			**29**	

5.3 Check the fuel delivery rate.			
	PROCEDURE	**MARK**	**TOTAL**
5.3.1	Obtain the delivery rate (fuel flow rate) specifications.	1	
5.3.2	Release fuel pressure from fuel system.	2	
5.3.3	Disconnect fuel hose.	1	
5.3.4	Insert fuel hose into measuring beaker.	1	
5.3.5	Switch ignition on.	1	
5.3.6	Measure the fuel delivery volume after ONE minute.	2	
	TOTAL – Fuel delivery rate – Procedure	**8**	

TOTAL – Fuel pressure test – Questions	13	
TOTAL – Fuel pressure test – Procedure	29	
TOTAL – Fuel delivery rate – Procedure	8	
GRAND TOTAL	**50**	

SIGNATURE OF CANDIDATE:		**DATE:**	

TASK 6: ENGINE COMPONENTS MEASUREMENTs AND CALCULATIONS

WORKSHEET 6.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS	MARK
6.1.1. Explain what is meant by *swept volume*.	2
6.1.2. Define *clearance volume*.	2
6.1.3. What do you understand by the term *compression ratio*?	2
6.1.4. Describe THREE methods to raise the compression ratio in an engine.	3
6.1.5. Describe THREE methods to lower the compression ratio in an engine.	3

6.1.6.	Use the following data to calculate the compression ratio. Stroke length = 80 mm Bore diameter = 70 mm Clearance volume = 35 cm^3	6
TOTAL - Engine components measurement and calculations –Questions	**18**	

TASK 6: ENGINE COMPONENTS MEASUREMENT – PROCEDURE

WORKSHEET 6.2 – ENGINE COMPONENTS MEASUREMENT

CANDIDATE'S NAME AND SURNAME: _____

ENGINE COMPONENTS MEASUREMENT
6.2 Measure the cylinder bore and crankshaft journal of an internal combustion engine. Answer the questions that follow.
PROCEDURE
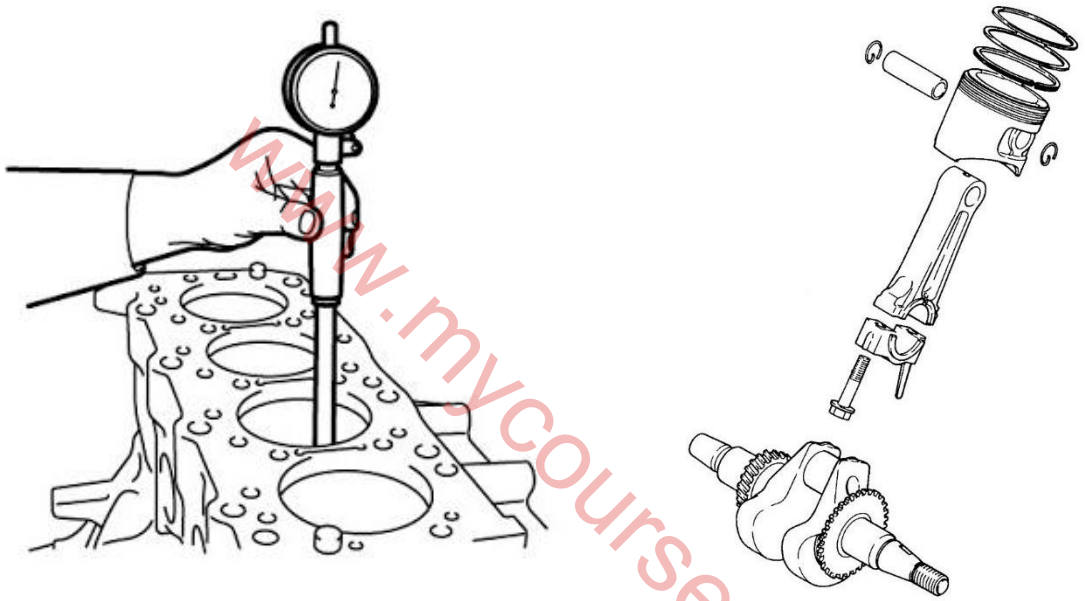
FIGURE 6.2: ENGINE BLOCK, CRANKSHAFT AND CONROD ASSEMBLY

6.2.1. Obtain specifications for the following.

COMPONENT	SPECIFICATION	MARK	TOTAL
Big-end journal		1	
Main journal		1	
Cylinder bore diameter		1	
Stroke length		1	
Big-end bearing clearance		1	
Mains bearing clearance		1	
TOTAL – Engine specifications		6	

6.2.2. Measure the main journal.

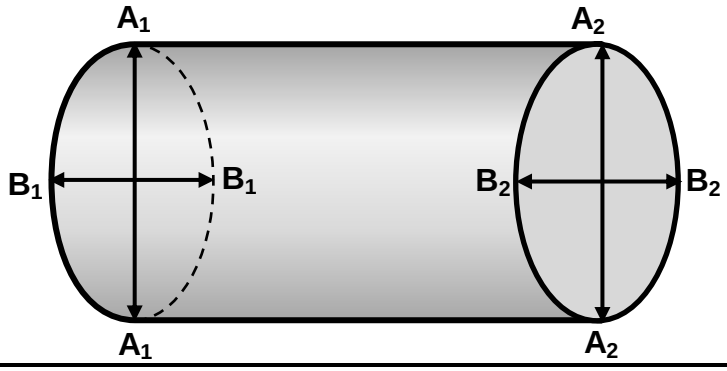

FIGURE 6.2.2: MAIN JOURNAL

DIMENSION	MEASUREMENT	MARK	TOTAL
A_1		2	
A_2		2	
B_1		2	
B_2		2	

6.2.3.	Calculate the *ovality*.		
	$A_1 - B_1 =$	1	
	$A_2 - B_2 =$	1	
6.2.4.	Calculate the *taper*.		
	$A_1 - A_2 =$	1	
	$B_1 - B_2 =$	1	
	TOTAL - Engine main journal measurement and calculations	**12**	

6.2.5.	Measure the cylinder bore.		

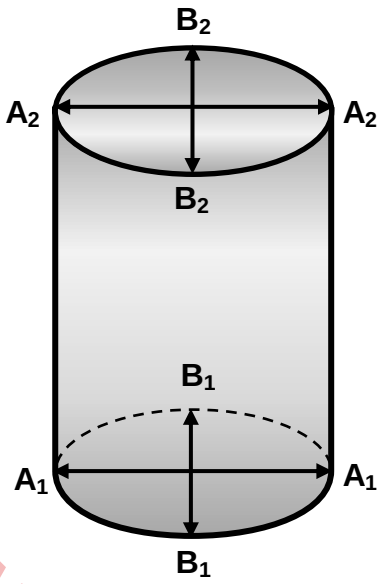

FIGURE 6.2.5: CYLINDER BORE

DIMENSION	MEASUREMENT	MARK	TOTAL
A_1		2	
A_2		2	
B_1		2	
B_2		2	
Stroke length		2	

6.2.6.	Calculate the ovality:		
	$A_1 - B_1 =$	1	
	$A_2 - B_2 =$	1	
6.2.7.	Calculate the *taper*:		
	$A_1 - A_2 =$	1	
	$B_1 - B_2 =$	1	
	TOTAL - Engine cylinder measurement and calculations	**14**	

TOTAL – Engine components measurement and calculations – Questions	18	
TOTAL - Engine specifications	6	
TOTAL – Engine main journal measurement and calculations	12	
TOTAL – Engine cylinder measurement and calculations	14	
GRAND TOTAL	**50**	

SIGNATURE OF CANDIDATE:		**DATE:**	

TASK 7: COMPUTERISED DIAGNOSTIC SCANNER

WORKSHEET 7.1 – QUESTIONS

CANDIDATE'S NAME AND SURNAME: _____

QUESTIONS		MARK
7.1.1.	What do the following abbreviations stand for?	
(a)	OBD	1
(b)	ECU	1
(c)	TCU	1
(d)	MAF	1
(e)	TPS	1
7.1.2.	Interpret the following fault code P0171:	
(a)	P	1
(b)	0	1
(c)	1	1
(d)	71	1
7.1.3.	State TWO manufacturer's specifications required to set up an OBD scanner.	2

7.1.4. State the FOUR basic functions of an OBD scanner.		4
7.1.5. Name FIVE systems that the OBD scanner can detect.		5
TOTAL – Computerised diagnostic scanner – Questions	**20**	

TASK 7: COMPUTERISED DIAGNOSTIC SCANNER

WORKSHEET 7.2 – PROCEDURE

CANDIDATE'S NAME AND SURNAME: _____

COMPUTERISED DIAGNOSTIC SCANNER			
7.2	Conduct a computerised diagnostic test on a vehicle using the OBD-II scanner.		
	PROCEDURE	**MARK**	**TOTAL**
7.2.1.	Check for any of the SIX obvious problems listed:	6	
7.2.2.	Obtain the VIN of the vehicle.	1	
7.2.3.	Obtain make and model of the vehicle.	1	
7.2.4.	Locate the car's OBD-II port.	1	
7.2.5.	Gain access to the car's OBD-II port.	1	
7.2.6.	Plug the diagnostic tool into the OBD-II port.	2	
7.2.7.	Access the diagnostic scanner.	2	
7.2.8.	Enter the vehicle's details into the scanner.	2	
7.2.9.	Turn on the vehicle's ignition.	2	
7.2.10.	Select the system to be scanned.	2	
7.2.11.	Perform a diagnostic scan.	2	
7.2.12.	Record any diagnostic trouble codes.	2	
7.2.13.	Clear the trouble codes and restart the diagnostic scan.	2	
7.2.14.	Read trouble code(s).	1	
7.2.15.	Interpret the trouble codes.	1	
7.2.16.	Make a diagnosis.	2	
	TOTAL – Computerised diagnostic scanner – Procedure	**30**	

TOTAL – Computerised diagnostic scanner – Questions	20	
TOTAL – Computerised diagnostic scanner – Procedure	30	
GRAND TOTAL	**50**	

SIGNATURE OF CANDIDATE:		**DATE:**	

5. SUMMARY MARK SHEET – TOTALS

MECHANICAL TECHNOLOGY											
AUTOMOTIVE											
MARK SHEET – TOTALS											
GRADE		12		DATE							
		CANDIDATES									
FACETS	MARKS	1	2	3	4	5	6	7	8	9	10
TASK _	50										
TASK _	50										
TASK _	50										
TASK 1 COMPULSORY	100										
TOTAL:	250										
TOTAL PAT MARK:	100										

NAME AND SIGNATURE OF TEACHER		
NAME AND SIGNATURE OF DEPARTMENTAL HEAD		
NAME AND SIGNATURE OF PRINCIPAL		
NAME AND SIGNATURE OF SUBJECT MODERATOR		

6. ANNEXURE A – SPECIFICATIONS SHEET

ENGINE:	
Type	
Bore and stroke	
Idling speed	
Maximum power	
Maximum torque	
Compression ratio	
Oil pressure	
Firing order	
Radiator cap pressure	
Thermostat opening pressure	

TRANSMISSION:	
Clutch type and diameter	
Gearbox	
Rear axle type	
Final drive type and ratio	
Speed in top gear per 1 000 r/min	

CAPACITIES:	
Sump without oil filter	
Gearbox	
Final drive	
Cooling system	
Fuel tank	

FUEL:	
Fuel system	
Aspiration	
Consumption	
CO emissions	
CO_2 emissions	
O_2 emissions	
Fuel type	

PISTONS AND RINGS:	
Piston clearance in bore	
Over sizes	
No of rings	
Groove clearance	
Ring gap in bore	

VALVES:	
Working clearance	
Inlet	
Exhaust	
Timing	
In opens	
In closes	
Timing	
Exhaust opens	
Exhaust closes	
Spring free length	
Spring rate	
Seat angle	
Valve lift	
Cam height	

IGNITION AND ELECTRICAL:	
Distributor type	
Stroboscopic setting	
Position of timing marks	
Spark plugs	
Spark plugs gap	
Battery	
Alternator	
Charging rate	
Regulator type	

CRANKSHAFT:	
5 main bearings	
Under sizes	
Clearance	
Big end	
Under sizes	
Clearance	
Small end bushes	

TORQUE SETTINGS:	
Flywheel	
Cylinder head	
Big ends	
Main bearings	
OHC bearing caps	

7. CONCLUSION

On completion of the practical assessment task (PAT), candidates should be able to demonstrate their understanding of the industry, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real-world challenges. The PAT furthermore develops candidate's life skills and provides opportunities for candidates to engage in their own learning.