basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MECHANICAL TECHNOLOGY (AUTOMOTIVE)

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS PAT)

GRADE 12

2022

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 learners 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 phases or a series of smaller activities that make up the PAT. The PAT allows for learners 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. tests or examinations. It is therefore important that schools ensure that all learners complete the practical assessment tasks within the stipulated period to ensure that learners 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 directly and systematically observe applied competence. 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 learner in each specialisation field. A nation's true wealth is in its manpower and education that should aim to develop the talents of a learner so that he/she can contribute to the well-being of the society by using and developing scientific and technological resources.

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

- An attitude where the learner can selectively use ideas, gather evidence and facts, to drawing 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 learner 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 learner physically and mentally. The learner 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 learners 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, learners can easily assess their progress. When formal assessment takes 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 Grades 10–12)*.

Teachers MUST build a prototype of the task in order to be able to demonstrate to the learners what the final product will look like. It will guide the learners with visual presentation. It provides the teacher with insight into possible challenges regarding machines, equipment or material and what possible manufacturing procedures he/she needs to follow in the workshop in order to complete the PAT.

NOTE: The learner has to execute the tasks in practice. The teacher must record reasons, findings, specifications, etc. provided by the learner on the worksheet.
Task 6, the worksheet, must be given to the learner as the calculations have to be done.

2.2 Assessment of PAT

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

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 learners. Formal assessment should always be conducted and recorded by the teachers.

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

2.3 Moderation of PAT

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

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

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 initials and surname of each learner.

2.4 Consequences of absence/non-submission of tasks.

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

A learner's results are regarded as incomplete if he/she does not offer any component of the PAT task. He/She will be given another opportunity based on the decision of the head of the assessment body. Should the learner fail to fulfil the outstanding PAT requirement, the marks for these components will be omitted and the final mark for Mechanical Technology will be adjusted for promotion purposes in terms of the completed tasks.

2.5 Declaration of Authenticity

NAME OF THE SCHOOL:

_____

NAME OF LEARNER:

_____
(FULL NAME(S) AND SURNAME)

NAME OF TEACHER:

_____

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

_____ _____
SIGNATURE OF LEARNER DATE

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

_____ _____
SIGNATURE OF TEACHER DATE

SCHOOL STAMP

3. LEARNERS GUIDELINES

Instructions to the learners

- The practical assessment task (PAT) consists of a compulsory task in **Automotive.** The compulsory task could be spread over three terms, as set out in this document. *(Also see CAPS document.)*
- All tasks must be completed according to the time frames set out in each of the tasks.
- Learners are requested to actively engage in all practical assessment tasks.
- Learners who are uncooperative will receive demerits or a zero mark for that particular section of the work.
- Learners who act unsafely in the workshop and place other learners in danger, will be given additional corrective tasks to improve their safety awareness.
- Your tasks must be fully completed by the end of August 2022 in order to be ready for provincial and/or national moderation.
- Your worksheets must to be **clearly marked** with your name and surname.
- At least one phase must be completed each term. The additional compulsory task must be completed during term 1, term 2 or term 3.

4. SPECIALISATION: AUTOMOTIVE (SPECIFIC)

Term: 1 to 3
Starting date: January 2022
Completion date: August 2022

INTRODUCTION:

This section comprises SEVEN practical tasks

TASK 1: Compression and cylinder leakage test is a **COMPULSORY TASK**

Choose any THREE of the SIX given tasks 2–7, namely:

TASK 2: Gas analysing test
TASK 3: Wheel balancing
TASK 4: Charging system
TASK 5: Fuel pressure test
TASK 6: Measuring engine components
TASK 7: Computerised diagnostic scanner

NOTE: TASK 1 IS **COMPULSORY**.
EXECUTE ANY **THREE** OF THE OTHER SIX TASKS GIVEN (TASKS 2–7).

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

The teacher must explain to the learners which knowledge and skills will be assessed during these tasks as well as the time to complete each task.

Activity outcome:

- Learners 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 learners should be assessed while performing these tasks.
- The learners should answer questions, record findings and give reasons for certain actions on the worksheet provided while they are performing these tasks.

TASK 1 (COMPULSORY)

TASK 1: COMPRESSION AND CYLINDER LEAKAGE TESTS

- WORKSHEET 1.1: COMPRESSION AND CYLINDER LEAKAGE TESTS – QUESTIONS
  - Answer the questions on WORKSHEET 1.1.
- WORKSHEET 1.2: COMPRESSION TEST – PROCEDURE
  - Perform the tasks as indicated on WORKSHEET 1.2 and record the findings and conclusions on WORKSHEET 1.2.
  - Use the specification manual to obtain readings for the engine that you are using to conduct the compression test.
  - Perform a dry and a wet compression test on a four-cylinder, four-stroke petrol engine and record the findings.
- WORKSHEET 1.3: CYLINDER LEAKAGE TEST – PROCEDURE
  - Perform a cylinder leakage test on a four-cylinder, four-stroke petrol engine and record the findings and conclusions on WORKSHEET 1.3.

TASK 2: GAS ANALYSING TEST

- WORKSHEET 2.1: GAS ANALYSING TEST – QUESTIONS
  - Answer the questions on WORKSHEET 2.1.
- WORKSHEET 2.2: GAS ANALYSING TEST – PROCEDURE
  - Perform the tasks as indicated on WORKSHEET 2.2.
  - Use the specification manual to obtain readings for the engine that you are using to conduct the gas analysis test.

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 as indicated on WORKSHEET 3.2.
  - Use a wheel balancing machine to balance a wheel.

TASK 4: CHARGING SYSTEM

- WORKSHEET 4: CHARGING SYSTEM – PROCEDURE
  - Perform the charging system test procedures on a vehicle and thereafter test the alternator components as 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 and record the findings on WORKSHEET 5.2.

TASK 6: ENGINE COMPONENT MEASUREMENT AND CALCULATIONS

- WORKSHEET 6.1: ENGINE COMPONENT 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 and calculations procedures on an engine and 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: COMPRESSION AND CYLINDER LEAKAGE TESTS – QUESTIONS

WORKSHEET 1.1

NAME:_____

QUESTIONS		MARK	TOTAL
1.1.1 Describe THREE differences between the *cylinder compression test* and the *cylinder leakage test*.		6	
COMPRESSION TEST:	**CYLINDER LEAKAGE TEST:**		
1.1.2 Describe FIVE safety precautions that must be adhered to while conducting the compression test.		5	

1.1.3	State FIVE causes of low compression in an engine.	5	
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 the higher compression reading in QUESTION 1.1.7.	2	
1.1.9	State FIVE causes of leakages in the cylinder of an internal combustion engine.	5	
	TOTAL – Compression and cylinder leakage tests – Questions	**31**	

TASK 1: COMPRESSION TEST – PROCEDURE

WORKSHEET 1.2

NAME:_____

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

(p) Compare the readings.	REASON:	2	
TOTAL – Dry compression test – Procedure		**35**	

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 piston.		1	
(b) Fit compression tester.		1	
(c) Open throttle valve fully.		1	
(d) Crank engine 4 to 10 times.		1	
(e) Record the readings.		1	
(f) Conclusions after the wet compression test.	REASON:	3	
(g) Replace spark plugs (turn plugs in by hand).		4	
(h) Reconnect electrical connections, and HT leads.		1	
(i) Reconnect fuel supply.		1	
TOTAL – Wet compression test – Procedure		**14**	

TOTAL – Dry compression test – Procedure	35	
TOTAL – Wet compression test – Procedure	14	
TOTAL – Compression test	**49**	

TASK 1: CYLINDER LEAKAGE TEST – PROCEDURE

WORKSHEET 1.3

NAME:_____

CYLINDER LEAKAGE TEST			
1.3 Perform the cylinder leakage test on one cylinder.			
PROCEDURE		**MARK**	**TOTAL**
1.3.1 Turn engine clockwise at front pulley.		1	
1.3.2 Turn engine until cylinder is on compression stroke.	REASON:	2	
1.3.3 Turn piston to TDC.		1	
1.3.4 Lock the crankshaft.		1	
1.3.5 Screw the spark-plug hose adapter into the spark-plug hole.		1	
1.3.6 Connect the leakage tester to the compressor.		1	
1.3.7 Calibrate the leakage tester.	REASON:	2	
1.3.8 Connect leakage tester to spark-plug hole adapter.		1	
1.3.9 Read the percentage leakage.		2	

1.3.10 Check for the cause of leakages.		8	
	TOTAL – Leakage test – Procedure	**20**	

COMPRESSION AND CYLINDER LEAKAGE TESTS MARK SUMMARY	**MARK**	**TOTAL**
TOTAL – Compression and cylinder leakage tests – Questions	31	
TOTAL – Compression test – Procedure	49	
TOTAL – Cylinder leakage test – Procedure	20	
TOTAL – Compression and cylinder leakage tests	**100**	

TASK 2: GAS ANALYSING TEST – QUESTIONS

WORKSHEET 2.1

NAME:_____

QUESTIONS	MARK	TOTAL
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 SIX gases that can be analysed by the exhaust gas analyser.	6	

2.1.4 State THREE safety precautions that must be adhered to when conducting an exhaust gas analysis.	3	
2.1.5 State FOUR causes of improper and incomplete combustion.	4	
2.1.6 What is the ideal air/fuel ratio for a spark ignition engine?	1	
TOTAL – Gas analysing test – Questions	**18**	

TASK 2: GAS ANALYSING TEST – PROCEDURE

WORKSHEET 2.2

NAME:_____

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 manufacturer' oxygen (O_2), carbon monoxide (CO) and carbon dioxide (CO_2) exhaust gas specifications for the engine to be tested.		3	
2.2.2 Ensure proper ventilation when conducting test.	REASON:	2	
2.2.3 Bring engine to operating temperature.	REASON:	2	
2.2.4 Ensure filters on analyser are clean.		1	
2.2.5 Check for any exhaust leaks.	REASON:	3	
2.2.6 Check for any vacuum leaks.	REASON:	2	
2.2.7 Switch on the gas analyser (connect cables to battery terminals or use switch).	REASON:	2	

2.2.8 Calibrate the analyser.	REASON:	2	
2.2.9 Ensure that the inlet hose is not restricted.		1	
2.2.10 Insert probe into exhaust tailpipe.		1	
2.2.11 Take the readings of the exhaust gases. (**Choose any TWO** of the following three gases, i.e. CO, O_2 and CO_2)			
(a) CO% results obtained		1	
Compare CO% reading with specifications.	CONCLUSION:	4	
(b) O_2% results obtained		1	
Compare O_2 reading with specifications	CONCLUSION:	4	
(c) CO_2% results 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**	

TASK 3: WHEEL BALANCING – QUESTIONS

WORKSHEET 3.1

NAME: _____

QUESTIONS		MARK	TOTAL
3.1.1	State THREE advantages of having the motor vehicle's wheels balanced.	3	
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 indicates different tyre wear conditions. State the cause of EACH condition A–C.	**A**  **B**  **C**  **FIGURE 3.1.6**	3
		A –	
		B –	
		C –	
3.1.7	State THREE safety measures that should be observed when performing wheel balancing.		3
		TOTAL – Wheel balancing – Questions	**17**

TASK 3: WHEEL BALANCING – PROCEDURE

WORKSHEET 3.2

NAME: _____

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.		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 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 damaged beads.		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	Check tyre pressure.		1	
3.2.11	Use the calliper to obtain the rim width.		1	
3.2.12	Enter wheel rim width into the wheel balancer.		1	
3.2.13	Use the off-set arm to measure the distance to the wheel		1	
3.2.14	Enter measurement into the wheel balancer.		1	
3.2.15	Close safety cover.		1	
3.2.16	Switch on the balancer and allow wheel to spin		1	
3.2.17	Obtain the imbalance reading on outer and inner part of the rim.	REASON:	2	
3.2.18	Remove wheel weights.		1	
3.2.19	Switch on wheel balancer to measure balancing on outer part of the rim.		1	
3.2.20	Close safety cover.		1	
3.2.21	Switch on the balancer and allow wheel to spin.		1	
3.2.22	Obtain the imbalance readings and its location on outer part of the rim.		1	
3.2.23	Choose the correct weights.		1	
3.2.24	Fit the weights correctly on the rim.		1	
3.2.25	Switch wheel balancer on to measure balancing on inner part of the rim.		1	
3.2.26	Close safety cover.		1	
3.2.27	Switch on the balancer and allow wheel to spin		1	
3.2.28	Obtain the imbalance readings and its location on inner part of the rim		1	
3.2.29	Choose correct weights.		1	

3.2.30 Fit the weights correctly on the rim.	1	
3.2.31 Re-check balancing.	1	
3.2.32 Remove wheel when it is balanced.	1	
TOTAL – Wheel balancing – Procedure	**33**	

TOTAL – Wheel balancing – Question	17	
TOTAL – Wheel balancing – Procedure	33	
GRAND TOTAL	**50**	

TASK 4: CHARGING SYSTEM – PROCEDURE

WORKSHEET 4

NAME:_____

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

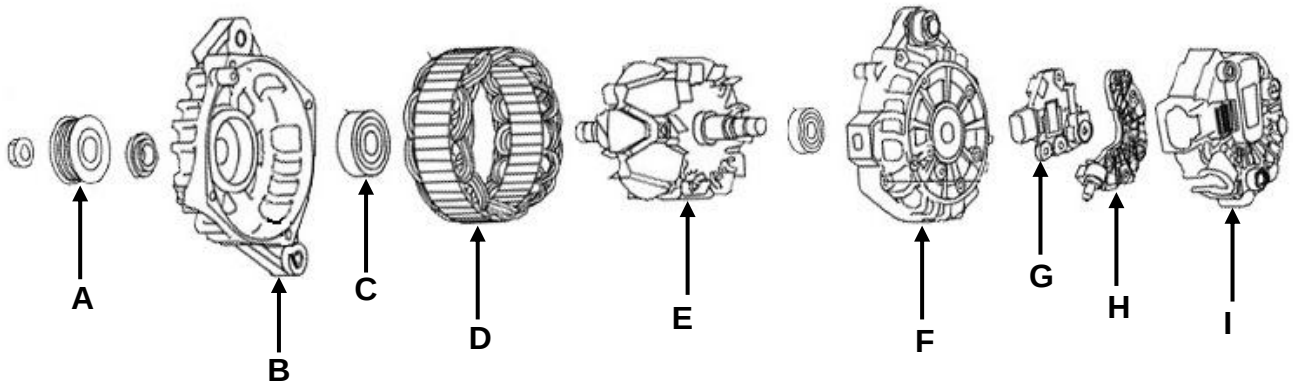

FIGURE 4.1

A.	**B.**
C.	**D.**
E.	**F.**
G.	**H.**
I.	

4.2 Test the charging system on a vehicle.

PROCEDURE		**MARK**	**TOTAL**
4.2.1 Obtain the manufacturer's specifications for the vehicle charging system.		2	
4.2.2 Check for loose electrical connections.		1	
4.2.3 Check the fan belt.		1	
4.2.4 Use multimeter to measure the battery voltage of the vehicle's idling.		2	
4.2.5 Measure battery voltage with load.		2	
TOTAL – Charging System – Procedure		**15**	

4.3 Test the following components of a dismantled alternator.				
PROCEDURE			**MARK**	**TOTAL**
Check the six diodes on the rectifier.				
4.3.1	Select continuity (buzzer) on the multimeter.		1	
4.3.2	Connect the multimeter to both sides of the diode.		6	
4.3.3	Report condition of diodes.		6	
Check stator for continuity.				
4.3.4	Connect the multimeter to the common connections and the other end to each of the three winding ends respectively.		3	
4.3.5	Report on the continuity of the stator windings.		3	
Check stator for earth leakage.				
4.3.6	Connect the multimeter to the stator framework and the other end to each of the three winding ends respectively.		3	
4.3.7	Report on the earth leakage of the stator windings.		3	
Check rotor for continuity.				
4.3.8	Connect multimeter to both slip rings.		1	
4.3.9	Report on the continuity of rotor windings.		1	
4.3.10	Check if slip rings are connected properly to rotor windings.		2	
4.3.11	Check slip rings for wear.		1	
Check rotor for earth leakage.				
4.3.12	Connect multimeter to rotor winding and rotor framework.		1	
4.3.13	Report on the earth leakage of rotor windings.		1	
4.3.14	End bracket/Cover for wear.		1	
4.3.15	Check front and rear bearings.		2	
		TOTAL – Alternator – Procedure	**35**	

TOTAL – Charging System – Procedure	15	
TOTAL – Alternator – Procedure	35	
GRAND TOTAL	**50**	

TASK 5: FUEL PRESSURE TEST– QUESTIONS

WORKSHEET 5.1

NAME: _____

QUESTIONS	MARK	TOTAL
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.	2	
5.1.4 State TWO functions of a check valve in the fuel system.	2	
5.1.5 State TWO possible faults and their corrective measures for low fuel pressure.	4	
FAULT / **CORRECTIVE MEASURE**		
(Any 2 x 2)		
TOTAL – Fuel pressure test – Questions	**12**	

TASK 5: FUEL SYSTEM TEST – PROCEDURE

WORKSHEET 5.2

NAME: _____

5.2 Conduct the fuel system pressure test in the correct sequence.					
PROCEDURE				**MARK**	**TOTAL**
5.2.1	Obtain the fuel pressure specifications:				
				3	
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 is not perished on the tester.			1	
5.2.7	Ensure that the tester's pressure relieve valve is working properly.			1	
5.2.8	Switch ignition on and off after the full pressure is reached.			2	
5.2.9	Fit fuel pressure tester to fuel line.			2	
5.2.10	Switch ignition on and off after the full pressure is reached.			2	
5.2.11	Check fuel pressure on gauge.			3	
5.2.12	Release pressure and connect to fuel hose on engine side as well.			2	
5.2.13	Switch ignition on and off after the full pressure is reached.			2	
5.2.14	Check fuel pressure on gauge.			2	
5.2.15	Check regulator vacuum hose for wetness.			2	
5.2.16	Check for leaking injectors.	1.	2.	4	
		3.	4.		
TOTAL – Fuel system test – Procedure				**30**	

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	12	
TOTAL – Fuel system test – Procedure	30	
TOTAL – Fuel delivery rate – Procedure	8	
GRAND TOTAL	**50**	

TASK 6: ENGINE COMPONENTS MEASUREMENT AND CALCULATIONS – QUESTIONS

WORKSHEET 6.1

NAME: _____

QUESTIONS	MARK	TOTAL
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 of raising the compression ratio in an engine.	3	
6.1.5. Describe THREE methods of lowering 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

NAME: _____

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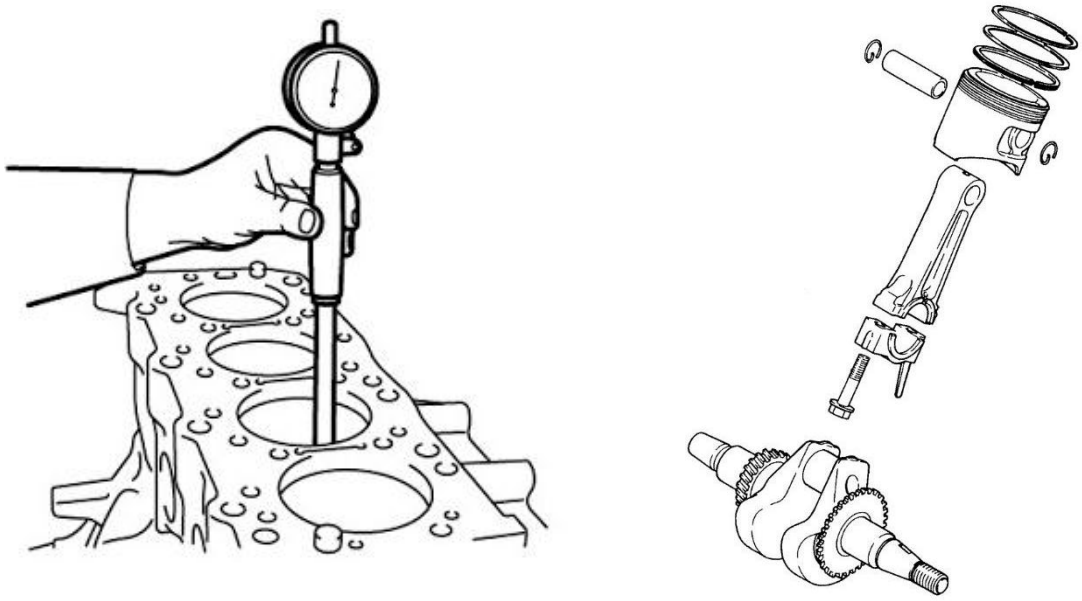
FIGURE 6.2: ENGINE BLOCK, CRANKSHAFT AND CONROD ASSEMBLY

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.

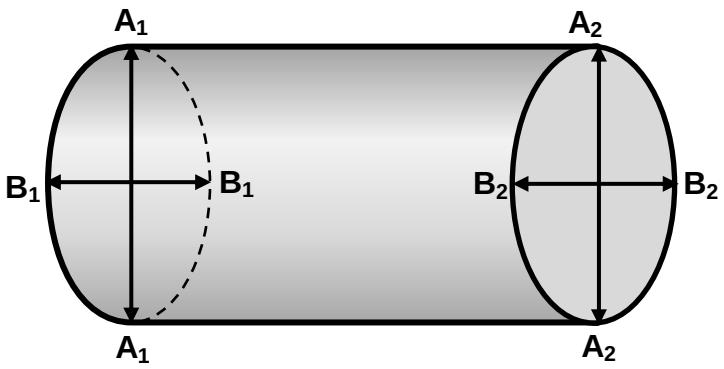

FIGURE 6.3: MAIN JOURNAL

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.

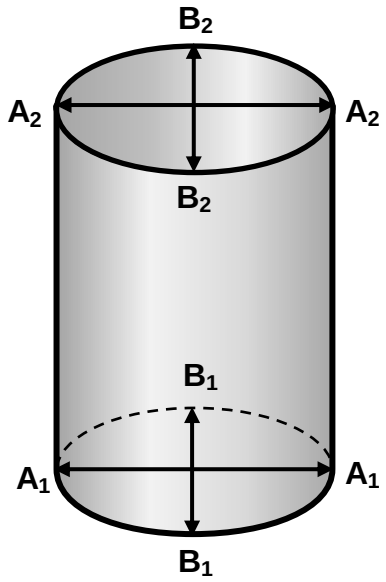

FIGURE 6.4: CYLINDER BORE

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**	

TASK 7: COMPUTERISED DIAGNOSTIC SCANNER – QUESTIONS

WORKSHEET 7.1

NAME: _____

QUESTIONS			MARK	TOTAL
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 the FOUR operational processes of an ECU.		4	

7.1.4	State TWO manufacturer's specifications required to set up an OBD scanner.	2	
7.1.5	State THREE basic functions of an OBD scanner.	3	
7.1.6	Name FOUR systems that the OBD can detect and that are managed by the ECU.	4	
	TOTAL – Computerised diagnostic scanner – Questions	**22**	

TASK 7: COMPUTERISED DIAGNOSTIC SCANNER

WORKSHEET 7.2

NAME: _____

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 obvious problems: ✓ • Fuel leaks and fuel level • Vacuum hoses that are disconnected or split • Corroded connectors • Unusual noises, smoke, or smell • Check the air filter • Check the oil level and condition • Check the coolant level and condition • Check the battery voltage **(Any 6 x 1)**	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	Perform a diagnostic scan.	2	
7.2.11	Record any diagnostic trouble codes.	2	
7.2.12	Clear the trouble codes and restart the diagnostic scan.	2	
7.2.13	Interpret the trouble codes and make a diagnosis	4	
	TOTAL – Computerised Diagnostic Scanner – Procedure	**28**	

TOTAL – Computerised diagnostic scanner – Questions	22	
TOTAL – Computerised diagnostic scanner – Procedure	28	
GRAND TOTAL	**50**	

5. SUMMARY MARK SHEET – TOTALS

MECHANICAL TECHNOLOGY											
AUTOMOTIVE											
MARK SHEET – TOTALS											
GRADE		12		DATE							
		LEARNERS									
FACETS	MARKS										
		1	2	3	4	5	6	7	8	9	10
PHASE 1 TASK ……	50										
PHASE 2 TASK ……	50										
PHASE 3 TASK ……	50										
PHASE 4 - TASK 1 …..	100										
TOTAL:	250										
TOTAL PAT MARK:	100										

NAME AND SIGNATURE OF TEACHER		
NAME AND SIGNATURE OF TECHNICAL DEPARTMENT HEAD		
NAME AND SIGNATURE OF PRINCIPAL		
NAME AND SIGNATURE OF SUBJECT MODERATOR		

6. ANNEXURE A

SPECIFICATIONS SHEET

ENGINE:	
Type	
Bore and stroke	
Idling speed	
Power max.	
Torque max.	
Compression ratio	
Oil pressure	
Firing order	
Radiator cap pressure	
Thermostat opening pressure	

TRANSMISSION:	
Clutch type and diagram	
Gearbox	
Rear axle type	
Final drive type and ratio	
Speed on 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	
Fuel system	
Aspiration	
Consumption	
CO emissions	
CO_2 emissions	
O_2 emissions	

PISTONS AND RINGS:	
Piston clearance in bore	
Oversizes	
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	

CRANKSHAFT:	
5 main bearings	
Undersizes	
Clearance	
Big end	
Undersizes	
Clearance	
Small end bushes	

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

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

7. CONCLUSION

On completion of the practical assessment task learners 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 the learner's life skills and provides opportunities for learners to engage in their own learning.