



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

NQF LEVEL 3

INTTEGRATED **S**UMMATIVE **A**SSESSMENT **T**ASK

SUBJECT ISAT:

**AUTOMOTIVE REPAIR AND
MAINTENANCE**

2014-2015

This document consists of 11 pages.

SECTION 1: INTRODUCTION

1. Practical purpose and value of the ISAT to the workplace.

This ISAT is a practical task that draws on the student's cumulative learning throughout the year and being acquainted with the needs of the industry. A checklist and a rubric are used as a tool to evaluate student's performance. The focus of this ISAT is not only to assess whether students can successfully perform each specific activity in the task, but also to determine whether they can integrate and apply their knowledge and skills in performing a world-of-work task. The purpose of the ISAT is also to afford students the opportunity to demonstrate creativity, innovation and problem solving skills.

The competence of the student is measured against the assessment criteria prescribed in the Subject and the Assessment Guidelines of 2014. This ISAT emanates from Topic 12 of the Level 3 Automotive Repair and Maintenance curriculum of 2014.

The ISAT should take place in a real life work-based situation and must be **executed under strict exam conditions**. The ISAT consist of activities which can be done in stages throughout the year.

2. Scope of the ISAT

Topic 12: Maintenance and Repair of Driveline and Related Components.

Subject Outcome: 12.1 Functioning and Operation of a 5 Speed Manual gearbox

Learning Outcomes:

- Explain different types of gears in a gearbox.
- Explain the functioning of a gearbox.
- Explain the relationship between gear ratio and torque.
- Explain the different types of gear lever arrangement.
- Describe the different types of gearboxes.
- Explain the power flow through different gears in a gearbox.

Subject Outcome: 12.2 Perform Repairs on a Front or Rear Wheel drive 5 Speed Manual Gearbox.

Learning Outcomes:

- Perform safety procedures when working on gearboxes.
- Use a manual to acquire the manufacture's specifications.
- Dismantle (strip) the gearbox and inspect all relevant parts for wear.
- Compile and submit a condition report.
- Replace worn or damage parts.
- Assemble the gearbox according to manufacturer's specifications.
- Complete relevant documentation to record repairs.

3. Task Descriptions

Activity ONE requires that the student must answer all 8 theoretical questions which total 30 marks and the duration is 30 minutes.

Activity TWO requires the student to dismantle and assemble the gearbox. This activity is worth 130 marks and must be completed within 5 hours 30 minutes. This activity must be carried out on a 5 speed front or rear wheel drive gearbox. The student must be able to complete all the 8 sub-tasks in the prescribed time. The total duration to complete both activities is **6 hours**. The time duration includes the preparing and restoring of the work area. Parts that are serviceable can be used again. After completion of the task, the student needs to demonstrate the selection of all the gears including the reverse gear. This is to test the operation of the gearbox and to ensure that all gears can be selected. This test must be conducted under the supervision of the assessor.

4. ISAT overview

This ISAT consists of TWO activities.

The first activity consists of EIGHT theoretical questions which have a total of 30 marks.

The second activity consists of EIGHT sub-tasks which add up to a total 130 marks.

Task	Activity	Time Allocation	Mark Allocation
1	Functioning and Operation of a 5 speed Manual gearbox (front or rear wheel drive).	30 min	30
2	Dismantle and Assemble a 5 speed Manual gearbox.	5 hours 30 min	130
	TOTAL	6 hours	160

5. Resource requirements

5.1 INFRASTRUCTURE	5.1.1 A workshop that complies with all safety regulations. 5.1.2 A well equipped workshop with the appropriate equipment.
5.2 MATERIALS / CONSUMABLES	5.2.1 Cleaning materials. 5.2.2 Container in which to drain the lubricant. 5.2.3 Waste bins and brooms. 5.2.4 Waste cloth. 5.2.5 Clipboard and suitable writing material to write a report.
5.3 PARTS (SAME PARTS CAN BE USED IF IT IS IN A GOOD WORKING CONDITION)	5.3.1 Recommended gearbox oil. 5.3.2 Oil seals. 5.3.3 Gaskets.
5.4 TOOLS/ EQUIPMENT	5.4.1 Appropriate hand tools. 5.4.2 Workshop manuals. 5.4.3 Parts Tray.
5.5 SPECIAL EQUIPMENT	5.5.1 Dial gauge. 5.5.2 Feeler gauge. 5.5.3 Torque wrench. 5.5.4 Pre-load gauge or Pull scale.

6. Assessment Tools

- A separate Marking Guideline is provided for activity ONE which the assessor should use to assess the student's performance in the task. This Marking Guideline must **NOT** be handed to students.
- In Task TWO, the student's performance should be measured using the Rubric and a Checklist provided. These assessment tools should **NOT** be made available to the students before or during the task.

SECTION 2: INSTRUCTIONS TO ASSESSOR

1. Study the ISAT as described in **SECTION 1**.
2. Arrange a pre-assessment interview with the students to inform them of the date(s), time(s) and venue of the ISAT. Also inform them about the requirements and conditions for the ISAT. Students also need to be aware of what is expected of them during the ISAT. Students need to be made aware that **the ISAT will be conducted under strict examination conditions**.
3. ALL safety practices and procedures must be adhered to.
4. The assessment centre should comply with the assessment standards.
5. All equipment used must be good, clean and in a safe working order.
6. All tools, vehicle data and safety equipment should be readily available to the student before and during assessment.
7. Students must protect themselves with the necessary Personal Protective Equipment (PPE). No student will be allowed to start the ISAT without PPE.
8. All waste must be discarded according to the Occupational Health and Safety Act (OHSA).
9. The assessor must intervene to protect the students from any unsafe act that could lead to injury and damage to property.
10. The assessor should monitor the students' conduct during the assessment. It is important that the assessor must ensure that the ISAT be carried out according to the examination rules.
11. ALL documents must be signed by the student and the assessor.
12. The duration of the task is 6 hours (5hours 30 min + 30 min) which is divided according to the instruction sheet to the student for the different activities.
13. **SECTION 3** contains the Assessment Tool for Task 2 which is a Rubric. The Rubric should be handed to students prior the conduct of the ISAT. See the separate Marking Guideline for possible responses to Task 1 and the checklist for Task 2.
14. A separate Marking Guideline (checklist) is provided which the assessor should use in conjunction with the Rubric in order to assess the student's performance. This Marking Guideline must **NOT** be handed to students before conducting the ISAT.

15. To calculate the final mark you need to add the scores of each sub-task in the rubric to the theoretical questions. The total marks need to be converted to a percentage. The total marks are 160 (30+130) for the complete ISAT.
16. Students must be given the "Instruction to Students" (contains an instruction sheet) which describes to them what needs to be done.
17. Student performance in the ISAT must conclude with a record of the student's performance as provided for in **SECTION 4**.

SECTION 3: ASSESSMENT TOOLS

TASK 1 – see Marking Guideline provided in a separate document

TASK 2 – Rubric (also see *CHECKLIST* in Marking Guideline provided in a separate document)

Perform Repairs on 5 Speed Manual Gearboxes.

Criteria no	Assessment Criteria	Level 4 Outstanding	Level 3 Highly Competent	Level 2 Competent	Level 1 Not Yet Competent	Marks scored
1	Prepare the work area according to work site procedures. (Max 8 marks)	All of the work site procedures were followed correctly. (8 marks)	Most of the work site procedures were followed correctly. (5-7 marks)	Adequate work site procedures were followed correctly. (4 marks)	Little or no work site procedures were followed. (0-3 marks)	
2	Use a manual to identify the manufactures specifications. (Max 9 marks)	All relevant information in service manual was used. (8-9 marks)	Most of the service manual was used. (5-7 marks)	Sufficient service manual information used. (4½ marks)	Service manual information not used. (0 -4 marks)	

3	Dis-assemble the gearbox and inspect all relevant parts for wear. (Max 20 marks)	Outstanding performance to inspect and dis-assemble gearbox was performed. (16 -20marks)	High level performance to inspect and dis-assemble gearbox was performed. (11-15 marks)	An adequate performance to inspect and dis-assemble gearbox was performed. (10marks)	Little or no performance to inspect and dis-assemble gearbox was performed. (0-9 marks)	
4	Compile and submit a condition report (Max 25 marks)	All of the correct steps were followed. (19-25 marks)	Most of the correct steps were followed. (13-18 marks)	Sufficient steps were followed. (12½ marks)	None of the correct steps were followed. (0-12 mark)	
5	Replace worn or damage parts (Max 25 marks)	All the correct steps to replace the parts were followed. (19-25 marks)	Most of the correct steps to replace the parts were followed. (13-18 marks)	Sufficient steps to replace parts were followed. (12½ marks)	None of the correct steps to replace parts were followed. (0-12 marks)	
6	Assemble the gearbox according to manufacture specifications (Max 25 marks)	All the correct steps to assemble the parts were followed. (19-25 marks)	Most of the correct steps to assemble the parts were followed. (13-18 marks)	Sufficient steps to assemble the parts were followed. (12½ marks)	None of the correct steps were followed to assemble the parts. (0-12 marks)	

7	Complete relevant documentation and record repairs (Max 8 marks)	All the correct steps to complete documents were followed. (8 marks)	Most of the correct steps to complete documents were followed. (5-7 marks)	Sufficient steps to complete documents were followed. (4 marks)	None of the correct steps were followed to complete documents. (0-3 marks)	
8	Restore work area (Max 10 marks)	All the correct steps to restore work area were followed. (9-10 marks)	Most of the correct steps to restore work area were followed. (6-8 marks)	Sufficient steps to restore work area were followed. (5 marks)	None of the correct steps were followed to restore work area. (0-4 marks)	

SECTION 4: RECORD OF PERFORMANCE

INTEGRATED SUMMATIVE ASSESSMENT TASK AUTOMOTIVE REPAIR AND MAINTENANCE LEVEL 3

College:	
Campus:	
Student's Surname and First Name/s:	
Student's ID Number:	
Assessor's Surname and Initials:	
Date of conclusion of assessment:	

ASSESSMENT GRID		
	MARK ALLOCATION	STUDENT'S MARK SCORED
TASK: 1 Functioning and Operation of a 5 Speed Manual gearbox	30	
TASK: 2 Dismantle and Assemble a 5 Speed Manual gearbox	130	
TOTAL	160	
PERCENTAGE ACHIEVED	%	

5-Point Achievement Rating Scale					
	5 (80- 100%)	4 (70-79%)	3 (50-69%)	2 (40-49%)	1 (0-39%)
Competency Level Indicators					
Rating Code	Rating		Marks %		
5	Outstanding		80 – 100 %		
4	Highly Competent		70 –79 %		
3	Competent		50 – 69 %		
2	Not Yet Competent		40 –49 %		
1	Not Achieved		0 – 39%		

Student's competence level:	
Student's signature:	
Lecturer's signature:	
Date and Time of	



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NQF LEVEL 3

INSTRUCTIONS TO STUDENTS

SUBJECT ISAT:

**AUTOMOTIVE REPAIR AND MAINTENANCE
LEVEL 3**

2014-2015

This document consists of 4 pages.

INSTRUCTIONS TO STUDENTS

This ISAT consists of a practical (130 marks) and theoretical (30 marks) task. This task tests your ability to apply the knowledge and skills acquired in the subject **Automotive Repair and Maintenance**. The work required of you in this Integrated Summative Assessment Task (ISAT) is an important and compulsory task that adds up to a total of 160 marks. **This task will be carried out under examination conditions.**

You are required to:

1. Ensure that you are punctual.
2. Ensure that you are wearing suitable **Personal Protective Equipment** (PPE).
3. Follow all safety precautions when carrying out the task. (Note: You will be prevented from continuing the task unless you rectify the mistakes as advised by the lecturer). **REMEMBER SAFETY FIRST.**
4. Identify and select appropriate hand tools and equipment to meet the requirements of the task.
5. Consult a service manual and adhere to manufacturer's specifications.
6. Ensure that you comply with **ALL** the instructions of the assessor.
7. Conduct all tasks according to safe working workshop procedures.
8. Clean the work area and discard waste material according to the Occupational Health and Safety Act (OHSA).
9. Your performance in each of the activities will be assessed by means of a rubric. The lecturer will use the rubric in conjunction with the checklist provided to mark your ISAT.

10. Write and submit a condition report on the work done for all sub-tasks to assist you to arrive at a conclusion about the condition of the gearbox.

10.1. You need to mention in your report what corrective action needs to be taken to solve the problems.

10.2. This report should also include findings and recommendations.

10.3. You also need to complete relevant documentation to record repairs.

QUESTIONS FOR TASK 1

1. Name the TWO common types of gears in a gearbox and explain TWO advantages and TWO disadvantages of each. (6)
 2. Explain the relationship between gear ratio and torque. (2)
 3. The first gear ratio is normally 3,8 : 1
Calculate the fifth gear ratio if a driving gear rotates at a speed of 3750 rpm and a driven gear rotates at a speed of 5000 rpm. (3)
 4. Name FIVE functions of a gearbox. (5)
 5. Explain the power flow in a gearbox when the reverse gear is selected. (6)
 6. Which gear is responsible for changing the direction (reverse) of rotation in the gearbox? (1)
 7. Describe the difference between a sliding mesh and a Constant mesh gearbox. (2)
 8. Explain the operation of a synchromesh unit when 3rd gear is selected. (5)
- TOTAL [30]**

INSTRUCTIONS FOR TASK 2

Dismantle and Assemble a 5 speed Manual Gearbox

Sub task	Activity 2	Time Allocation	Mark Allocation
1	Prepare the work area and follow safety procedures for working on gearboxes. Obtain the appropriate hand tools and equipment.	20 min	8
2	Use a service manual to obtain manufacturer's specifications. Mount the gearbox safely and remove the drain plug and drain the oil.	24 min	9
3	Perform a visual inspection on the gearbox and do all the pre-checks. Remove bell housing, inspection cover and extension housing.	52 min	20
4	Remove the main shaft, input and cluster gear. Dis-assemble the gearbox completely and lay out parts in a parts tray. Clean and examine the condition of the parts.	63 min	25
5	Compile and submit a condition report on the parts and replace the faulty parts.	63 min	25
6	Start to assemble the gears on the main shaft. Install cluster gear, main shaft, input shaft and all other parts and assemble the rest of the gearbox according to manufacture specifications.	63 min	25
7	Operate the gear lever to test if all gears can be selected this include the reverse gear. Complete relevant documentation to record.	20 min	8
8	Restoring the work area: Clean the tools and return it. Clean the special tools and equipment and return it to the store.	25 min	10
	TOTAL	330 min	130



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NQF LEVEL 3

MARKING GUIDELINES

SUBJECT ISAT:

AUTOMOTIVE REPAIR AND MAINTENANCE

2014-2015

This document consists of 5 pages

TASK 1

Question 1

Spur Gear: (1)

- Advantages
 - Mechanical efficiency is high
 - Cheap to manufacture
 - Reduce side thrust

(Any two responses) (2 X ½)

- Disadvantages
 - Gears are noisy
 - Requires considerable skill to change. (2 X ½)

Helical Gear: (1)

- Advantages
 - Provide greater tooth contact
 - Operate quieter (2 X ½)
- Disadvantages
 - More expensive
 - Cannot slide easily into mesh (2 X ½)

Question 2

- Gear ratio is the speed of the input shaft to the speed of the output shaft. (1)
- Torque: A big gear will have a slow speed and a high torque and vice versa. (1)

Question 3

- Gear Ratio=Speed of driving gear/ Speed of Driven gear (1)
- Gear Ratio=3750 rpm/ 5000 rpm (1)
- Gear Ratio=0,75 : 1 (1)

Question 4

- Provide permanent neutral (1)
- Allows vehicle to operate satisfactorily when climbing an incline (1)
- Enable the engine torque to increase (1)
- Provide a forward and reverse gear (1)
- Increase the leverage over the driving shaft. (1)

Question 5

- Power flows from the input shaft (1)
- Through the cluster gear (1)
- Reverse idler gear (1)
- Reverse gear (1)
- Synchro sleeve (1)
- Synchro hub (1)
- Main shaft (1)

Max 6

Question 6

- Reverse idler gear (1)

Question 7

- In a sliding mesh gearbox, the gears on the output shaft can slide from side to side in order to engage the gears on the lay shaft. (1)
- In a constant mesh gearbox, all the gears on the output shaft are constantly in mesh with their corresponding gears on the lay shaft. (1)

Question 8

- When the driver shifts gears, the synchronizer sleeve slides on its splined hub towards the selected output gear. The synchro ring rubs on the side of the third gear cone. (1)
- Friction causes the speed of the gear, synchronizer and output shaft to eventually turn at the same speed. (1)
- When the speed of the three components is the same, the synchro-sleeve can slide completely over the synchro ring and over the dog teeth on the output gear. (1)
- This locks the output gear to the synchronizer hub and to the main shaft. (1)
- Torque is then transmitted to the output gear and the output shaft, to the drive shaft and the wheels. (1)

TOTAL [30]

TASK 2 – Checklist for rubric

Dismantle and Assemble a 5 speed Manuel gearbox

1	Prepare the work area.	2
	Obtain the appropriate hand tools and special tools.	3
	Obtain the correct equipment.	3
2	Obtain a service manual	3
	Mount the gearbox and follow safety procedures	3
	Remove drain plug and drain oil.	3
3	Perform a visual inspection on the gearbox.	3
	Do all the pre-checks.	7
	Remove following:	
	Bell housing	3
	Inspection cover	3
4	Extension housing.	4
	Remove the following :	
	Main shaft	5
	Input	5
	Cluster gear.	5
	Dismantle the rest of the gearbox completely	5
	Lay out parts in a parts tray.	1
5	Clean and examine the condition of the parts	4
	Prepare a condition report on the parts.	5
6	Replace the faulty parts.	20
	Start to assemble the gears on the main shaft.	5
	Install the following:	
	Cluster gear	5
	Main shaft	5
	Input shaft	5
7	Assemble the rest of the gearbox.	5
	Operate the gear lever to see if all gears can be selected.	3
	Complete relevant documentation to record repairs that was done on the gearbox.	5
8	Restoring the work area:	
	Clean the work area and discard waste material	4
	Clean the tools and store it away.	3
	Clean the special tools and equipment and return it to the store.	3