Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

VEHICLE MANUAL TRANSMISSION SYSTEM MAINTENANCE

AUTMT401

Competence: Maintain vehicle manual transmission system.

RQF Level: 4

Learning Hours: 120

Credits: 12

Sector: **Transport and logistics**

Trade: **Automobile technology**

Module Type: **Specific**

Curriculum: **TRLAUT4001- TVET Level IV in Automobile technology**

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Purpose statement	This module describes the knowledge, skills and attitude required to repair manual transmission system. It is intended to be pursued by learner at TVET certificate level IV in automobile technology. At the end of this module trainees will be able to maintain clutch System, maintain manual gear box and transfer box, maintain propeller shaft and axle shaft and maintain final drive with differential with minimum supervision.					
Leaning assumed to be in place	Implement SHE policies and procedures, Overhaul diesel engine, Repair diesel engine systems					
Delivery modality	**Training delivery**		**100%**	**Assessment**		**Total 100%**
	Theoretical content		30%	Formative assessment	30%	50%
	Practical work:		70%		70%	
	• Group project and presentation	20%				
	• Individual project /Work	50%				
				Summative Assessment		50%

Elements of Competency and Performance Criteria

Elements of competency	Performance criteria
1. **Maintain Clutch System**	1.1. Types of clutch system are appropriately identified according to the type of clutch control.
	1.2. Clutch system components are properly identified according to the type of clutch system.
	1.3. Clutch system components are properly described according to the type of clutch system.
	1.4. Tools, materials, and equipment are properly selected according to the job to be done.
	1.5. The clutch system is appropriately inspected according to the type of clutch system.
	1.6. The clutch system components are appropriately dismounted according to the repair procedures.

	1.7. The clutch system components are appropriately disassembled according to the manufacturer instructions
	1.8. The clutch components faults are exactly inspected/cleaned according to the manufacturer instructions.
	1.9. The clutch system damaged components are properly adjusted/ rectified/greased/replaced according to repair manuals.
	1.10. The clutch system components are properly reassembled according to the manufacturer instructions
	1.11. The clutch system components are properly remounted according to the repair procedures
	1.12. The clutch system is properly bled and refilled based on the clutch type.
	1.13. The clutch system is correctly tested according to the manufacturer instructions.
2. **Maintain manual gear box and transfer box**	2.1. Types of manual gear box and transfer box are appropriately identified according to their installation position and shifting mechanism.
	2.2. Types of manual gear box and transfer box are appropriately described according to their installation position and shifting mechanism
	2.3. Manual gear box and transfer box components are appropriately identified according to the type of gear box and transfer box
	2.4. manual gear box and transfer box components are appropriately described according to the type of gear box and transfer box.
	2.5. Tools, materials, and equipment are properly selected according to the type of gear box and transfer box
	2.6. The manual gear box and transfer box are appropriately inspected according to their types.
	2.7. The manual gear box and transfer box oil are drained according to the manufacturer's instructions
	2.8. The manual gear box and transfer box with its accessories are appropriately dismounted according to the repair procedures

	2.9. The manual gear box and transfer box are methodically disassembled according to the manufacturer instructions
	2.10. The manual gear box and transfer box components are properly cleaned/inspected according to the diagnosis procedure
	2.11. The manual gear box and transfer box damaged components are properly replaced /greased according to damaged parts
	2.12. The manual gear box and transfer box components are properly reassembled according to the manufacturer instructions
	2.13. The manual gear box and transfer box are correctly reassembled according to the manufacturer procedures
	2.14. The manual gear box and transfer box with its accessories are adequately remounted according to the repair manual
	2.15. The manual gear box and transfer box oil are properly tested according to the repair manual
	2.16. The manual gear box and transfer box oil are properly refilled according to the repair manual
3. **Maintain propeller shaft and axle shaft**	3.1 Type of Propeller Shaft and Axle shaft are appropriately identified according to the transmission types
	3.2 Type of Propeller Shaft and Axle shaft are appropriately described according to the transmission types
	3.3 The Propeller Shaft and Axle shaft components are appropriately identified according to the type of propeller shaft and axle shaft.
	3.4 The Propeller Shaft and Axle shaft components are appropriately described based on the propeller and axle shaft
	3.5 Tools, materials, and equipment are properly selected based on the job to be done
	3.6 The propeller shaft and axle shaft are correctly inspected according to the propeller and axle shaft mechanism
	3.7 The Propeller Shaft and Axle shaft are appropriately dismantled according to the

	repair manual
	3.8 The Propeller Shaft and Axle shaft components are cleaned /inspected according to the manufacturer instructions.
	3.9 The Propeller Shaft and Axle shaft damaged components are properly replaced/greased based on damaged parts
	3.10 The Propeller Shaft and Axle shaft components are correctly reassembled according to manual procedures
	3.11 The Propeller Shaft and axle Shaft are properly remounted according to the repair procedures
	3.12 The Propeller Shaft and axle Shaft are correctly tested according to the functionality
4. **Maintain final drive with differential.**	4.1 Final drive with differential type is correctly identified
	4.2 Final drive with differential components is correctly identified based on the type
	4.3 The Final drive with differential is appropriately described according to the repair manual
	4.4 The Final drive with differential components is appropriately described according to the repair manual
	4.5 Tools, materials, and equipment are properly selected based on the job to be done
	4.6 The Final drive with differential is appropriately inspected according to the repair manual
	4.7 The Final drive with differential oil is drained according to the manufacturer's instructions
	4.8 The final drive with differential is appropriately dismounted according to the manual procedures
	4.9 The final drive with differential components are appropriately disassembled according to the repair manual

	4.10 The final drive with differential components are properly cleaned/inspected according to the repair procedures
	4.11 The final drive with differential damaged components are properly replaced/adjusted based on repair manual
	4.12 The final drive with differential components are properly reassembled according to the repair manual
	4.13 The final drive with differential is appropriately remounted according to the repair procedures
	4.14 The final drive with differential oil is correctly refilled according to the manufacturer instructions
	4.15 The final drive with differential is properly tested according to the repair manual

Intended Knowledge, Skills, and Attitude

Knowledge	Skills	Attitude
✓ Types of tools, materials, and equipment ✓ Basic mechanical principles ✓ Mechanical attitude ✓ Applied mathematics ✓ Applied physics ✓ Applied chemistry ✓ Safety rules, precautions and security ✓ Fluids principles ✓ Use of Personal Protective equipment ✓ Technical drawing ✓ Interpretation of specification	✓ Computer skills ✓ Communication skills ✓ Troubleshooting skills ✓ Report elaboration skills ✓ Good service delivering skills ✓ Interpersonal skills ✓ Analytical skills ✓ Problem-solving skills ✓ Task management skills ✓ Parts replacement skills ✓ Diagnostic skills ✓ Proper use of measurement instruments. ✓ Use of tools, materials and equipment	✓ Honest ✓ Accountability ✓ Self-motivated ✓ Gender sensitive ✓ Customer care oriented ✓ Decisive ✓ Time management ✓ Humble ✓ Creative ✓ Patient ✓ Responsible ✓ Innovative ✓ Flexible ✓ Integrity ✓ Goal oriented ✓ Self-confident

Course content

Learning outcomes	At the end of the module the learner will be able to: 1. Maintain Clutch System 2. Maintain Gear Box and Transfer Box 3. Maintain Propeller Shaft and Axle shaft. 4. Maintain Final Drive with Differential
Learning outcome 1: Maintain Clutch System	**Learning hours: 30**

Indicative content

- **Identification of clutch types.**
  - ✓ Mechanical clutch control
  - ✓ Hydraulic clutch control
- **Identification and description of clutch system components.**
  - ✓ Pressure plate
  - ✓ Clutch disc
  - ✓ Release bearing
  - ✓ Clutch fork
  - ✓ Clutch cable
  - ✓ Master cylinder
  - ✓ Slave cylinder
  - ✓ Hydraulic lines
  - ✓ Clutch pedal
- **Selection of Tools, materials, and equipment**
  - ✓ Hand tools
  - ✓ Power tools
  - ✓ Measuring tools
  - ✓ Materials
  - ✓ Equipment
- **Inspection of clutch system.**

- ✓ Looseness of clutches system components
- ✓ Leakage of hydraulic clutch system
- ✓ Wear of clutches system components

- **Dismounting of clutch system components.**
  - ✓ Friction clutches system components
    - Pressure plate
    - Clutch disk
    - Release bearing
    - Clutch fork
    - Clutch cable
    - Flywheel
    - Clutch pedal
  - ✓ Hydraulic clutch system components
    - Master cylinder
    - Slave cylinder
    - Clutch fork
    - Hydraulic lines
    - Clutch disc
    - Flywheel
    - Pressure plate
    - Clutch pedal
- **Disassembling of clutch system components.**
  - ✓ Disassembling procedures
- **Inspection /cleaning of clutch components faults.**
  - ✓ Wear
  - ✓ Hose and pipes condition
  - ✓ Components condition
  - ✓ cleaning of clutch components
- **Adjustment/rectification/greasing/replacement of clutch system damaged components.**
  - ✓ Adjustment of friction clutches system components

- Free play

✓ Rectification

- Fly wheel
- Pressure plate

✓ Greasing of clutch system components

- Clutch fork
- bearings

✓ replacement of friction clutch system damaged components

- Pressure plate
- Clutch disk
- Release bearing
- Clutch fork
- Clutch cable
- Brake pedal

✓ replacement of hydraulic clutch system damaged components

- Multiplate clutch
- Master cylinder
- Slave cylinder
- Clutch fork
- Hydraulic lines
- Brake pedal

- **Reassembling of clutch system components.**
  - ✓ Reassembling procedures
- **Remounting of clutch system components.**
  - ✓ Remounting procedures
- **Bleeding and refilling of clutch system.**
  - ✓ Bleeding procedures
- **Testing of clutch system.**
  - ✓ Functionality

Resources required for the learning outcome	
Equipment	Air compressor, Car lifter, Bench vice, Dust bin, Repair bench, Hydraulic jack, Transmission jack, Transmission jack stand, PPE, Multimeter, Drain pan, Hoists, Grease gun. Service bay
Materials	Water, Solvents, Sandpapers, Silicon, Rags, Grease, Clutch fluid, clutch system spare parts
Tools	Complete toolbox, Screwdrivers, Hammer, Pliers, Files, Cutters, Punches and chisels, Bolts extractors, Threads restore kit or taper, Air impact spanners, Vernier caliper, Dial gauge, 4WD wheel bearing lock nut wrench, Bearing Race & Seal Driver Tools, Axle Nut Deep Impact Sockets, Clutch alignment tool, Front wheel drive bearing adapter kit.
Facilitation techniques	• Demonstration • simulation • Group discussion • Practical exercises
Formative assessment methods	• Written assessment. • Performance assessment • Product based assessment

Learning outcome 2: Maintain manual gear box and transfer box.	**Learning hours: 40**
Indicative content	

- **Identification of manual gear box types and transfer box**
  - ✓ Transversal and longitudinal manual gearbox
    - Sliding mesh gearbox
    - Constant mesh gearbox
    - synchromesh
  - ✓ Four-wheel drive types
    - Part time transfer box
    - Full time transfer box
  - ✓ All wheel drive types.
    - Part time all wheel
    - Full time all wheel
- **Description of manual gear box and transfer box types**

- ✓ Transversal and longitudinal manual gearbox
  - Sliding mesh gearbox
  - Constant mesh gearbox
  - synchromesh
- ✓ Four-wheel drive types
  - Part time transfer box
  - Full time transfer box
- ✓ All wheel drive types.
  - Part time all wheel
  - Full time all wheel

- **Description of manual gear box and transfer box components.**
  - ✓ Manual gearbox components
    - Gearbox shafts
    - Gearbox gears
    - Gearbox bearings
    - Synchromesh devices
    - Shift rails
    - Shift fork
    - Gearbox seals
    - interlocks
  - ✓ Transfer box components
    - Transfer box shafts
    - Transfer box gears
    - Transfer box bearings
    - Transfer box chain
    - Transfer box case
    - Transfer box flange
    - Transfer box shift rail
    - Transfer box shift fork
    - Transfer box seals

- Transfer box selector sleeves

- **Selection of Tools, materials, and equipment**
  - ✓ Hand tools
  - ✓ Power tools
  - ✓ Measuring tools
  - ✓ Materials
  - ✓ Equipment
- **Inspection of manual gear box and transfer box.**
  - ✓ Looseness of gear box and transfer box linkage
  - ✓ Leakage of gear box and transfer box
  - ✓ Condition of gear box and transfer box mounts
- **Draining of manual gear box and transfer box oil**
  - ✓ Draining procedures of manual gearbox.
  - ✓ Draining procedures of transfer box.
- **Dismounting of manual gear box and transfer box with its accessories**
  - ✓ dismounting process of manual gearbox
    - transversal
    - longitudinal
  - ✓ dismounting process of transfer box
- **Disassembling of manual gear box and transfer box**
  - ✓ Disassembling procedures of manual gear box and transfer box
- **cleaning /inspection of manual gear box and transfer box components**
  - ✓ Cleaning of manual gearbox components
    - Gearbox shafts
    - Gearbox gears
    - Gearbox bearings
    - Synchromesh devices
    - Shift rail
    - Shift fork
    - Gearbox seals

- ✓ Cleaning of transfer box components
  - Transfer box shafts
  - Transfer box gears
  - Transfer box bearings
  - Transfer box chain
  - Transfer box case
  - Transfer box flange
  - Transfer box shift rail
  - Transfer box shift fork
  - Transfer box seals
  - Transfer box selector sleeves
- ✓ Inspection of manual gearbox components conditions
  - Gearbox shafts
  - Gearbox gears
  - Gearbox bearings
  - Synchromesh devices
  - Shift rail
  - Shift fork
  - Gearbox seals
- ✓ Inspection of transfer box components conditions
  - Transfer box shafts
  - Transfer box gears
  - Transfer box bearings
  - Transfer box chain
  - Transfer box case
  - Transfer box flange
  - Transfer box shift rail
  - Transfer box shift fork
  - Transfer box seals
  - Transfer box selector sleeves

- **replacement the manual gear box and transfer box damaged components.**
  - ✓ replacement of manual gearbox components
  - ✓ Replacement of transfer box components
- **Reassembling of manual gear box and transfer box components.**
  - ✓ Reassemble procedures of manual gear box and transfer box components.
- **Reassembling of manual gear box and transfer box.**
  - ✓ Reassemble procedures of gear box and transfer box.
- **remounting of manual gear box and transfer box with its accessories.**
  - ✓ remounting procedures of manual gearbox with its accessories.
    - transversal
    - longitudinal
  - ✓ dismounting process of transfer box with its accessories.
- **Refiling of manual gear box and transfer box.**
  - ✓ Manual gear box and transfer box oil types and properties
  - ✓ Refiling procedures
- **Testing of manual gear box and transfer box.**
  - ✓ Function test

Resources required for the indicative content	
Equipment	Hydraulic press, drilling machine, grinding machine, Air compressor, Car lifter, Sucking pump, Bench vice, Dust bin, Repair bench, Hydraulic jack, Transmission jack, Transmission jack stand, PPE, Multimeter, Drain pan, Hoists, Driveline fluid filler pump, Scan tool
Materials	Water, Solvents, Sandpapers, Silicon, Rags, Grease, gearbox oil, Driveline spare parts.
Tools	Complete toolbox, Screwdrivers, Hammer, bearing Pliers, Files, Cutters, Punches and chisels, Bolts extractors, Threads restore kit or taper, Air impact spanners, Vernier caliper, Dial gauge, Gear puller, U-joint removal tools, 4WD wheel bearing lock nut wrench, Bearing Race & Seal Driver Tools, Axle Nut Deep Impact Sockets, Grease gun, Front wheel drive bearing adapter kit, Axle poppet kit, Gear wrench universal ball joint separator
Facilitation techniques	• Demonstration and simulation • Individual and group work • Group discussion • Practical exercises
Formative assessment	• Written assessment.

methods	• Performance assessment • Product based assessment

Learning outcome 3: Maintain propeller shaft and axle shaft	Learning hours: 20

Indicative content

- **Identification of propeller shaft and axle shaft.**
  - ✓ Identify types of propeller shaft
    - Single piece propeller shaft
    - Two pieces' propeller shaft
  - ✓ Identify types of axle shaft
    - Full floating
    - Semi floating
    - Three quarter floating axle shaft
- **Description of propeller shaft and axle shaft types.**
  - ✓ Describe types of propeller shaft
    - Single piece propeller shaft
    - Two pieces' propeller shaft
  - ✓ Describe types of axle shaft
    - Full floating
    - Semi floating
    - Three quarter floating axle shaft
- **Description of Propeller Shaft and Axle shaft components.**
  - ✓ propeller shaft components
    - Shaft tube
    - Universal joint
    - Slip yoke.
    - Flange
  - ✓ Axle shaft components
    - shaft

- Seals and boots
- Bearings
- Constant velocity joints (CV joints)

- **Tools, materials, and equipment are properly selected.**
  - ✓ Hand tools
  - ✓ Power tools
  - ✓ Measuring tools
  - ✓ Materials
  - ✓ Equipment
- **Inspection of propeller shaft and axle shaft.**
  - ✓ Looseness of joints
  - ✓ Bending of propeller shaft and axle shaft
- **Dismounting of propeller shaft and axle shaft.**
  - ✓ Dismounting procedures of propeller shaft and axle shaft
- **Cleaning and inspection of propeller shaft and axle shaft components**
  - ✓ propeller shaft components
    - Shaft tube
    - Universal joint
    - Slip yoke.
    - Flange
  - ✓ Axle shaft components
    - shaft
    - Seals and boots
    - Bearings
    - Constant velocity joints (CV joints)
- **Replacement/greasing of Propeller Shaft and Axle shaft damaged components.**
  - ✓ Replacement of propeller shaft components
    - Shaft tube
    - Universal joint
    - Slip yoke.

- Flange

✓ Replacement of axle shaft components

- shaft
- Seals and boots
- Bearings
- Constant velocity joints (CV joints)

✓ Greasing of universal joints

✓ Greasing of CV joints

✓ Greasing of slip yoke

- **Reassembling of propeller shaft and axle shaft components.**

✓ Universal joints

✓ CV joints

- **Remounting of propeller Shaft and axle Shaft.**

✓ Propeller Shaft

✓ Axle Shaft

- **Testing of propeller shaft and axle shaft.**

✓ Propeller shaft function test

✓ Axle shaft function test

Resources required for the indicative content	
Equipment	Hydraulic press, Air compressor, Car lifter, Bench vice, Dust bin, Repair bench, Hydraulic jack, Transmission jack, Transmission jack stand, PPE, Hoists, grease gun.
Materials	Water, Solvents, Sandpapers, Silicon, Rags, Grease, cv joints, propeller shafts, universal joints.
Tools	Complete toolbox, Screwdrivers, Hammer, bearing Pliers, Files, Cutters, Punches and chisels, Bolts extractors, Threads restore kit or taper, Air impact spanners, Vernier caliper, Dial gauge, U-joint removal tools, 4WD wheel bearing lock nut wrench, Bearing Race & Seal Driver Tools, Axle Nut Deep Impact Sockets, Front wheel drive bearing adapter kit, Axle poppet kit, Gear wrench universal ball joint separator
Facilitation techniques	• Demonstration • simulation • Practical exercise

	• Group discussion
Formative assessment methods	• Written assessment. • Performance assessment • Product based assessment • Project based assessment
Learning outcome 4: Maintain final drive with differential	**Learning hours: 30**
Indicative content	

- **Identification of final drive with differential types.**
  - ✓ Final drive types
    - Spur gear final drive
    - Helical gear final drive
    - Bevel gear final drive
    - Worm gear final drive
  - ✓ differential types based on locking mechanism.
    - Open differential
    - Limited slip differential
    - Viscous limited differential
    - Torsen differential
    - Active differential
- **Identification of final drive with differential components.**
  - ✓ Final drive components
    - Crown wheel
    - Pinion
  - ✓ differential components based on locking mechanism types.
    - Open differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts.
    - Limited slip differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts, clutch plate, springs.
    - Viscous limited differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts, friction plate, springs.
    - Torsen differential components: Side gears, differential gears, differential pin, differential

case, worm wheel, worm gear, synchromesh gear.

- Active differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts, electronic clutch plate control, springs.

- **Description of final drive with differential.**
  - ✓ Final drive types
    - Spur gear final drive
    - Helical gear final drive
    - Bevel gear final drive
    - Worm gear final drive
  - ✓ differential types based on locking mechanism.
    - Open differential
    - Limited slip differential
    - Viscous limited differential
    - Torsen differential
    - Active differential
- **Selection of tools, materials, and equipment.**
  - ✓ Hand tools
  - ✓ Power tools
  - ✓ Measuring tools
  - ✓ Materials
  - ✓ Equipment
- **Inspection of final drive with differential.**
  - ✓ Leakage of final drive with differential
- **Draining of final drive with differential oil.**
  - ✓ Procedures of draining final drive with differential oil
- **Dismounting of final drive with differential.**
  - ✓ Procedures of dismounting final drive with differential
- **Disassembling of final drive with differential components.**
  - ✓ Procedures for disassembling final drive.
  - ✓ Procedures for disassembling differential

- **Cleaning / inspection of final drive with differential components.**
  - ✓ Final drive components
    - Crown wheel
    - Pinion
  - ✓ Open differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts.
  - ✓ Limited slip differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts, clutch plate, springs.
  - ✓ Viscous limited differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts, friction plate, springs.
  - ✓ Torsen differential components: Side gears, differential gears, differential pin, differential case, worm wheel, worm gear, synchromesh gear.
  - ✓ Active differential components: Side gears, differential gears, differential pin, differential case, adjusting nuts, electronic clutch plate control, springs.
- **Replacement / adjustment of final drive with differential damaged components.**
  - ✓ Replacement of final drive components
    - Crown wheel
    - Pinion
  - ✓ Replacement of differential components based on locking mechanism types.
    - Open differential components:
    - Side gears, differential gears, differential pin, differential case, adjusting nuts.
    - Limited slip differential components:
    - Side gears, differential gears, differential pin, differential case, adjusting nuts, clutch plate, springs.
    - Viscous limited differential components:
    - Side gears, differential gears, differential pin, differential case, adjusting nuts, friction plate, springs.
    - Torsen differential components:
    - Side gears, differential gears, differential pin, differential case, worm wheel, worm gear, synchromesh gear.

- Active differential components:
- Side gears, differential gears, differential pin, differential case, adjusting nuts, electronic clutch plate control, springs.

✓ Adjustment of final drive components

- Backlash
- Pinion gear preload
- Drive pinion depth
- Side bearing preload.

- **Reassembling of final drive with differential components.**
  - ✓ Reassembling procedures of final drive components
  - ✓ Reassembling procedures of differential components
- **Remounting of final drive with differential.**
  - ✓ Procedures of remounting final drive with differential
- **Refiling of final drive with differential oil.**
  - ✓ Procedures of refiling final drive with differential oil
- **Testing of final drive with differential.**
  - ✓ Function test

Resources required for the indicative content	
Equipment	Hydraulic press, Air compressor, Car lifter, sucking pump, Bench vice, Dust bin, Repair bench, Hydraulic jack, Transmission jack, Transmission jack stand, PPE, Multimeter, Drain pan, Hoists, Driveline fluid filler pump.
Materials	Water, Solvents, Sandpapers, Silicon, Rags, Grease, gear oil, final drive with differential spare parts.
Tools	Complete toolbox, Screwdrivers, Hammer, bearing Pliers, Files, Cutters, Punches and chisels, Bolts extractors, Threads restore kit or taper, Air impact spanners, Vernier caliper, Dial gauge, Gear puller, U-joint removal tools, 4WD wheel bearing lock nut wrench, Bearing Race & Seal Driver Tools, Axle Nut Deep Impact Sockets, Grease gun, Front wheel drive bearing adapter kit, Axle poppet kit, Gear wrench universal ball joint separator, Scan tool.
Facilitation techniques	• Demonstration • simulation • Practical exercise • Group discussion

Formative assessment methods	• Written assessment. • Performance assessment • Product based assessment • Project based assessment

Integrated/Summative assessment (For specific module)

Integrated situation

Mr MUGISHA is a businessman in NGOMA District and has Toyota Hilux (4*4) 2010. He was driving his vehicle from KIBUNGO sector to his storeroom located at sake sector. During his return, it was raining and the road surface was very slippery then his decided to shift his vehicle from 2 wheels drive into 4 wheel drive low range, when he arrived at KIBUNGO sector, he heard a grinding noise in transmission system when he shifted in 4 wheel drive, then he brought his vehicle at UMURAVA garage for repair, the garage foreman inspect it and found that the problem was worn transfer case bearings or gears, then the garage foreman assign you as an automobile manual transmission technician to solve this problem within 6 hours.

Resources

Tools	Complete toolbox, Screwdrivers, Hammer, bearing Pliers, Files, Cutters, Punches and chisels, Bolts extractors, Threads restore kit or taper, Air impact spanners, wheel bearing lock nut wrench, Bearing Race & Seal Driver Tools, Axle Nut Deep Impact Sockets, Grease gun, Front wheel drive bearing adapter kit, Axle poppet kit, Gear wrench universal ball joint separator.
Equipment	Hydraulic press, Air compressor, Car lifter, sucking pump, Bench vice, Dust bin, Repair bench, Hydraulic jack, Transmission jack, Transmission jack stand, PPE, Multimeter, Drain pan, Hoists, Driveline fluid filler pump.
Materials/ Consumables	Water, Solvents, Sandpapers, Silicon, Rags, Grease, gear oil.

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
1. Learning outcome 1: Maintain Clutch System (25%)	1.1. Types of clutch system are appropriately identified according to the type of clutch control.	Clutch systems are appropriately identified			1
	1.2. Clutch system components are properly identified according to the type of clutch system.	Clutch system components are properly identified			1
	1.3. Clutch system components are properly	Clutch system			2

	described according to the type of clutch system.	components are properly described			
	1.4. Tools, materials, and equipment are properly selected according to the job to be done.	Tools, materials, and equipment are properly selected			1
	1.5. The clutch system is appropriately inspected according to the type of clutch system.	Clutch system is appropriately inspected			1
	1.6. The clutch system components are appropriately dismounted according to the repair procedures.	Clutch system components are appropriately dismounted			3
	1.7. The clutch system components are appropriately disassembled according to the manufacturer instructions	Clutch system components are appropriately disassembled			2
	1.8. The clutch components faults are exactly inspected/cleaned according to the manufacturer instructions.	Clutch components faults are exactly inspected/cleaned			3
	1.9. The clutch system damaged components are properly adjusted/ rectified/greased/replaced according to repair manuals.	Clutch system damaged components are properly adjusted/ rectified/greased/replaced			2
	1.10. The clutch system components are properly reassembled according to the manufacturer instructions	Clutch system components are properly reassembled			3
	1.11. The clutch system components are properly remounted according to the repair procedures	Clutch system components are properly remounted			2
	1.12. The clutch system is properly bled and refilled based on the clutch type.	Clutch system is properly bled and refilled			2
	1.13. The clutch system is correctly tested according to the manufacturer instructions.	Clutch system is properly bled and refilled			2
2. Learning outcome 2: Maintain	2.1. Types of manual gear box and transfer box are appropriately identified according to their installation position and shifting mechanism.	Types of gear box and transfer box are appropriately identified			1

manual gear box and transfer box (30%)	2.2. Types of manual gear box and transfer box are appropriately described according to their installation position and shifting mechanism	Types of gear box and transfer box are appropriately described			1
	2.3. The manual gear box and transfer box components are appropriately identified according to the type of gear box and transfer box	Gear box and transfer box components are appropriately identified			1
	2.4. The manual gear box and transfer box components are appropriately described according to the type of gear box and transfer box.	Gear box and transfer box components are appropriately described			2
	2.5. Tools, materials, and equipment are properly selected according to the type of gear box and transfer box	Tools, materials, and equipment are properly selected			2
	2.6. The manual gear box and transfer box are appropriately inspected according to their types.	The gear box and transfer box are appropriately inspected			2
	2.7. The manual gear box and transfer box oil are drained according to the manufacturer's instructions	The gear box and transfer box oil are drained			2
	2.8. The manual gear box and transfer box with its accessories are adequately dismounted according to the repair manual	The gear box and transfer box accessories are adequately dismounted			4
	2.9. The manual gear box and transfer box are methodically disassembled according to the manufacturer instructions	The gear box and transfer box are methodically disassembled			2
	2.10. The manual gear box and transfer box components are appropriately disassembled according to the manufacturer instructions	The gear box and transfer box components are appropriately disassembled			2
	2.11. The manual gear box and transfer box	The gear box and			2

	components are properly cleaned/inspected according to the diagnosis procedure	transfer box components are properly cleaned/inspected			
	2.12. The manual gear box and transfer box damaged components are properly replaced /greased according to damaged parts	The gear box and transfer box damaged components are properly replaced /greased			2
	2.13. The manual gear box and transfer box components are properly reassembled according to the manufacturer instructions	The gear box and transfer box components are properly reassembled			2
	2.14. The manual gear box and transfer box are correctly reassembled according to the manufacturer procedures	The gear box and transfer box are correctly reassembled			2
	2.15. The manual gear box and transfer box with its accessories are adequately remounted according to the repair manual	The gear box and transfer box accessories are adequately remounted			2
	2.16. The manual gear box and transfer box oil are properly refilled according to the repair manual	The gear box and transfer box oil are properly refilled			1
3. Learning outcome 3: Maintain Propeller Shaft and Axle shaft. (20%)	3.1. Type of Propeller Shaft and Axle shaft are appropriately identified according to the transmission types.	Type of Propeller Shaft and Axle shaft are appropriately identified			1
	3.2. Type of Propeller Shaft and Axle shaft are appropriately described according to the transmission types	Type of Propeller Shaft and Axle shaft are appropriately described			1
	3.3. The Propeller Shaft and Axle shaft components are appropriately identified according to the type of propeller shaft and axle shaft.	The Propeller Shaft and Axle shaft components are appropriately identified			1
	3.4. The Propeller Shaft and Axle shaft components are appropriately described based on the propeller and axle shaft	The Propeller Shaft and Axle shaft components are appropriately described			2

	3.5. Tools, materials, and equipment are properly selected based on the job to be done	Tools, materials, and equipment are properly selected			1
	3.6. The propeller shaft and axle shaft are correctly inspected according to the propeller and axle shaft mechanism	The propeller shaft and axle shaft are correctly inspected			2
	3.7. The Propeller Shaft and Axle shaft are appropriately dismantled according to the repair manual	The Propeller Shaft and Axle shaft are appropriately dismantled			2
	3.8. The Propeller Shaft and Axle shaft components are cleaned /inspected according to the manufacturer instructions.	The Propeller Shaft and Axle shaft components are cleaned /inspected			2
	3.9. The Propeller Shaft and Axle shaft damaged components are properly replaced/greased based on damaged parts	The Propeller Shaft and Axle shaft damaged components are properly replaced/greased			2
	3.10. The Propeller Shaft and Axle shaft components are correctly reassembled according to manual procedures	The Propeller Shaft and Axle shaft components are correctly reassembled			2
	3.11. The Propeller Shaft and axle Shaft are properly remounted according to the repair procedures	The Propeller Shaft and axle Shaft are properly remounted			2
	3.12. The Propeller Shaft and axle Shaft are correctly tested according to the functionality	The Propeller Shaft and axle Shaft are correctly tested			2
4. Learning outcome 4: Maintain Final Drive with Differential (25%)	4.1. Final drive with differential type is correctly identified	Final drive with differential type is correctly identified			1
	4.2. Final drive with differential components are correctly identified based on the type	Final drive with differential components is correctly identified			1
	4.3. The Final drive with differential is appropriately described according to the repair manual	The Final drive with differential is appropriately described			2
	4.4. The Final drive with differential components are appropriately described according to the	The Final drive with differential			2

	repair manual	components are appropriately described			
	4.5. Tools, materials, and equipment are properly selected based on the job to be done	Tools, materials, and equipment are properly selected			1
	4.6. The Final drive with differential is appropriately inspected according to the repair manual	The Final drive with differential is appropriately inspected			2
	4.7. The Final drive with differential oil is drained according to the manufacturer's instructions	The Final drive with differential oil is drained			2
	4.8. The final drive with differential is appropriately dismounted according to the manual procedures	The final drive with differential is appropriately dismounted			2
	4.9. The final drive with differential components are appropriately disassembled according to the repair manual	The final drive with differential components are appropriately disassembled			2
	4.10. The final drive with differential components are properly cleaned/inspected according to the repair procedures	The final drive with differential components are properly cleaned/inspected			2
	4.11. The final drive with differential damaged components are properly replaced/adjusted based on repair manual	The final drive with differential damaged components are properly replaced/adjusted			2
	4.12. The final drive with differential components are properly reassembled according to the repair manual	The final drive with differential components are properly reassembled			1
	4.13. The final drive with differential is appropriately remounted according to the repair procedures	The final drive with differential is appropriately remounted			2
	4.14. The final drive with differential oil is correctly refilled according to the	The final drive with differential oil is			2

	manufacturer instructions	correctly refilled			
	4.15. The final drive with differential is properly tested according to the repair manual	The final drive with differential is properly tested			2
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate): 70%					

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