Republic of Rwanda
Ministry of Education

RTB | RWANDA TVET BOARD

DIESEL ENGINE OVERHAULING

AUTDO401

Competence: Overhaul Diesel Engine

RQF Level: 4

Learning Hours: 60

Credits: 6

Sector: Transport and Logistics

Trade: Automobile Technology

Module Type: Specific

Curriculum: TRLAUT4001- TVET Certificate IV in Automobile Technology

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<table>
<tr><td>Purpose statement</td><td colspan="5">This module describes the knowledge, skills and attitude required to overhaul Diesel engine with minimum supervision. It is intended to be pursued by learner at TVET level IV for TVET Certificate IV in Automotive technology. At the end of this module, learners will be able to Dismantle Diesel engine from the vehicle, Overhaul Diesel engine and remount Diesel engine.</td></tr>
<tr><td>Leaning assumed to be in place</td><td colspan="5">Safety, Health and environment at workplace, Repair automotive petrol engine and repair diesel engine systems.</td></tr>
<tr><td rowspan="6">Delivery modality</td><td colspan="2">Training delivery</td><td>100%</td><td colspan="2">Assessment</td><td>Total 100%</td></tr>
<tr><td colspan="2">Theoretical content</td><td>30%</td><td rowspan="4">Formative assessment</td><td>30%</td><td rowspan="4">50%</td></tr>
<tr><td colspan="2">Practical work:</td><td rowspan="3">70%</td><td rowspan="3">70%</td></tr>
<tr><td>• Group project and presentation</td><td>20%</td></tr>
<tr><td>• Individual project /Work</td><td>50%</td></tr>
<tr><td colspan="2"></td><td colspan="2">Summative Assessment</td><td>50%</td></tr>
</table>

Elements of Competency and Performance Criteria	
Elements of competency	**Performance criteria**
1. Dismantle Diesel engine from the vehicle	1.1. The types of engine are properly identified based on Diesel injection system
	1.2. The engine components are properly described based on Diesel injection system
	1.3. Tools, materials, and equipment are properly selected based on type of maintenance
	1.4. Engine fluids are correctly drained based on environment compliance.
	1.5. Engine accessories /attachments are properly disconnected from the engine according to the manual instructions.
	1.6. Diesel Engine is completely dismounted from the vehicle according to the repair procedures.
2. Overhaul Diesel engine	2.1. Tools, materials, and equipment are properly selected based on the work to be done
	2.2. Engine components are completely disassembled according to the repair manual
	2.3. Engine components are properly cleaned/inspected and checked according to the engine components initial status

	2.4. Engine damaged components are properly adjusted/ replaced according to repair manual
	2.5. Engine components are methodically re-assembled according to the assembling procedures
3. Remount Diesel engine	3.1. Tools, materials, and equipment are properly selected based on the work
	3.2. Engine is correctly re-mounted to the vehicle according to the repair manual
	3.3. Engine accessories and attachments are properly re-connected to the engine according to user manual
	3.4. Engine fluids are correctly re-filled based on indicated level
	3.5. Engine fuel supply system is properly bled according to the manufacturer's instructions
	3.6. Vehicle engine performance is properly tested based on functionality.

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 ✓ Use of Personal Protective equipment ✓ Technical drawing ✓ Theory of welding ✓ Types of tools, materials, and equipment ✓ Technical symbols ✓ Interpretation of specifications ✓ Quality of materials	✓ 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. ✓ Basic welding skills ✓ 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. Dismantle Diesel engine from the vehicle 2. Overhaul Diesel engine 3. Remount Diesel engine
Learning outcome 1: Dismantle diesel engine from the vehicle	**Learning hours: 12**
Indicative content	

- **Identification of types of diesel engine**
  - ✓ Direct injection
  - ✓ Indirect injection
- **Description of diesel engine components**
  - ✓ Cylinder head cover
  - ✓ Intake manifold
  - ✓ Cylinder head
  - ✓ Exhaust manifold
  - ✓ Camshaft
  - ✓ Cylinder block
  - ✓ Pistons
  - ✓ Crankshaft
  - ✓ Timing chain assembly
  - ✓ Oil pan
  - ✓ Engine gasket kit
  - ✓ Flywheel
- **Selection of tools, materials and equipment**
  - ✓ Tools
  - ✓ Materials
  - ✓ Equipment
- **Draining of engine fluids**
  - ✓ Coolant
  - ✓ Engine oil
  - ✓ Refrigerant
- **Disconnecting of diesel engine accessories and attachments**
  - ✓ Starter battery

- ✓ Starter motor
- ✓ Turbo-charger unit
- ✓ Fun
- ✓ Water pump
- ✓ Radiator
- ✓ Hydraulic pump
- ✓ A/C pump
- ✓ Exhaust manifold
- ✓ Transmission unit
- ✓ Intake manifold

- **Dismounting of diesel engine from the vehicle to the bench work**

Resources required for the learning outcome	
Equipment	Projector, computer, Personal protective equipment (PPE), Multimeter, Oil pan, Connecting rod aligner, Hydraulic press, Engine hoist, Air compressor, Timing light, Engine compression tester, Spark plugs cleaner and tester, Injector cleaner and tester, Engine stand, engine crane
Materials	Whiteboard, marker pen, black board, chalk, flipchart, Bolts and nuts, Rags, Wire brushes, soft brushes, Sanding paper, Air filter, Oil filter, Fuel filter, auto data, Engine oil, Anti-rust, Exhaust gaskets, Solvents, Grinding paste, Silicon, Gasket kit, Piston rings, Con bearing, Main bearing, Trust washer, Piston pin bushing, Camshaft bushing, Cylinder liner, Air hose, Crankshaft oil seals, Timing belt, Injectors nozzle, injectors, Glow plugs, engine, repair manuals
Tools	Spanners, set of screw drivers, pry bar, chipping hummer, Chisels, Scriber, Ruler, Allen key, Hummers, scan tool, Torque wrench, Cylinder bore gauge, Circlips plier, Punches, Core plugs remover, Oil gun, Blow gun, Puller, Filler gauge
Facilitation techniques	• Group discussion • Trainer guided • Brainstorming • Demonstration • Simulation
Formative assessment methods	• Written assessment • Oral based assessment • Performance based assessment • Product based assessment

Learning outcome 2: **Overhaul diesel engine**	**Learning hours: 36**
Indicative content	

- **Selection of tools, materials and equipment**
    - ✓ Tools
    - ✓ Materials
    - ✓ Equipment
- **Disassembling, cleaning and inspection of diesel engine components**
    - ✓ Cylinder head cover
    - ✓ Intake manifold
    - ✓ Cylinder head
    - ✓ Exhaust manifold
    - ✓ Camshaft
    - ✓ Cylinder block
    - ✓ Pistons
    - ✓ Crankshaft
    - ✓ Timing chain assembly
    - ✓ Oil pan
    - ✓ Engine gasket kit
    - ✓ Flywheel
- **Adjustment and replacement of diesel engine damaged components**
    - ✓ Cylinder head cover
    - ✓ Intake manifold
    - ✓ Cylinder head
    - ✓ Exhaust manifold
    - ✓ Camshaft
    - ✓ Cylinder block
    - ✓ Pistons
    - ✓ Crankshaft
    - ✓ Timing chain assembly
    - ✓ Oil pan
    - ✓ Engine gasket kit
    - ✓ Flywheel

- **Re-assembling of diesel engine components**
    - ✓ Cylinder head cover
    - ✓ Intake manifold
    - ✓ Cylinder head
    - ✓ Exhaust manifold
    - ✓ Camshaft
    - ✓ Cylinder block
    - ✓ Pistons
    - ✓ Crankshaft
    - ✓ Timing chain assembly
    - ✓ Oil pan

✓ Engine gasket kit ✓ Flywheel

Resources required for the indicative content	
Equipment	Projector, computer, Personal protective equipment (PPE), Multimeter, Oil pan, Connecting rod aligner, Hydraulic press, Engine hoist, Air compressor, Timing light, Engine compression tester, Spark plugs cleaner and tester, Injector cleaner and tester, Engine stand, engine crane
Materials	Whiteboard, marker pen, black board, chalk, flipchart, Bolts and nuts, Rags, Wire brushes, soft brushes, Sanding paper, Air filter, Oil filter, Fuel filter, auto data, Engine oil, Anti-rust, Exhaust gaskets, Solvents, Grinding paste, Silicon, Gasket kit, Piston rings, Con bearing, Main bearing, Trust washer, Piston pin bushing, Camshaft bushing, Cylinder liner, Air hose, Crankshaft oil seals, Timing belt, Injector nozzles, injectors, Glow plugs, engine parts, repair manuals
Tools	Spanners, set of screw drivers, pry bar, chipping hummer, Chisels, Scriber, Ruler, Allen key, Hummers, scan tool, Torque wrench, Cylinder bore gauge, Circlips plier, Punches, Core plugs remover, Oil gun, Blow gun, Puller, Filler gauge.
Facilitation techniques	• Group discussion • Trainer guided • Brainstorming • Demonstration • Simulation
Formative assessment methods	• Written assessment • Oral based assessment • Performance based assessment • Product based assessment

Learning outcome 3: Remount diesel engine	Learning hours: 12
Indicative content	

- **Selection of tools, materials and equipment**
  - ✓ Tools
  - ✓ Materials
  - ✓ Equipment
- **Re-mounting of diesel engine to the vehicle**
- **Re-connecting of diesel engine accessories and attachments**
  - ✓ Starter battery

- ✓ Starter motor
- ✓ Turbo-charger unit
- ✓ Cooling fun
- ✓ Water pump
- ✓ Radiator
- ✓ Hydraulic pump
- ✓ Air conditioning compressor
- ✓ Exhaust manifold
- ✓ Transmission unit
- ✓ Intake manifold

- **Re-filling of diesel engine fluids**
  - ✓ Coolant
  - ✓ Engine oil
  - ✓ Refrigerant
- **Bleeding of diesel engine fuel supply**
- **Testing of vehicle engine performance**
  - ✓ Static
  - ✓ Dynamic

Resources required for the indicative content	
Equipment	Projector, computer, Personal protective equipment (PPE), Multimeter, Oil pan, Connecting rod aligner, Hydraulic press, Engine hoist, Air compressor, Timing light, Engine compression tester, Spark plugs cleaner and tester, Injector cleaner and tester, Engine stand, engine crane
Materials	Whiteboard, marker pen, black board, chalk, flipchart, Bolts and nuts, Rags, Wire brushes, soft brushes, Sanding paper, Air filter, Oil filter, Fuel filter, Auto data, Engine oil, Anti-rust, Exhaust manifold gasket, Solvents, Grinding paste, Silicon, engine gasket kit, Piston rings, Con bearing, Main bearing, Trust washer, Piston pin bushing, Camshaft bushing, Cylinder liner, Air hose, Crankshaft oil seals, Timing belt, Injectors nozzle, injectors, Glow plugs, engine, repair manuals
Tools	Spanners, set of screw drivers, pry bar, chipping hummer, Chisels, Scriber, Ruler, Allen key, Hummers, scan tool, Torque wrench, Cylinder bore gauge, Circlips plier, Punches, Core plugs remover, Oil gun, Blow gun, Puller, Filler gauge.
Facilitation techniques	• Group discussion • Trainer guided • Brainstorming • Demonstration • Simulation
Formative assessment	• Written assessment

methods	• Oral based assessment • Performance based assessment • Product based assessment

Integrated/Summative assessment

Integrated situation

KALISA is a driver of REG, he brought the car Toyota land cruiser PRADO with diesel engine at SEBU Garage located in KICUKIRO District GATENGA sector for intervention. He told a receptionist that the car has the following problem: The lack of engine power, more smoke and engine oil consumption. After the engine diagnosing, the results shows that the engine needs to be overhauled.

The head of the Garage requested you as an engine mechanic to perform the engine overhauling within 8 hours.

Tools	Spanners, Screw drivers, Tire lever, Chisels, Scriber, Ruler, Hummer, Vernier caliper, Micrometer, Torque wrench, Cylinder bore gauge, Dial gauge, Straightedge, Piston ring compressor, Piston ring expander, Valve spring compressor, Circlips plier, Punches, Core plugs remover, Valve grinder, Oil gun, Blow gun, Puller, Filler gauge
Equipment	Personal protective equipment (PPE), Multimeter, Valve grinding machine, Hydraulic press, Oil pan, Connecting rod aligner, Engine hoist, Air compressor, Timing light, Engine compression tester, Spark plugs cleaner and tester, Injector cleaner and tester, Engine stand, Table, engine crane.
Materials/ Consumables	Exhaust gaskets, Bolts and nuts, Rags, Wire brushes, cleaning brush, Solvents, Grinding paste, Sanding paper, Silicon, Gasket kit, Piston rings, Con bearing, Main bearing, Trust washer, Piston pin bushing, Camshaft bushing, Cylinder liner, Air filter, Oil filter, Fuel filter, Engine oil, Air hose, Crankshaft oil seals, Timing belt, Spark plugs, Injectors nozzle, injectors, Glow plugs, Anti-rust

Assessable outcomes	Assessment criteria (Based on performance criteria)	Indicator	Observation		Marks allocation
			Yes	No	
Learning outcome 1: **Dismantle diesel engine from the vehicle** **(30%)**	1.1. The types of engine are properly identified based on Diesel injection system	The types of engine are properly identified			3
	1.2. The engine components are properly described based on Diesel injection system	The engine components are properly described			8
	1.3. Tools, materials, and equipment are properly selected based on type of maintenance	Tools, materials, and equipment are properly selected			3

	1.4. Engine fluids are correctly drained based on environment compliance.	Engine fluids are correctly drained			3
	1.5. Engine accessories /attachments are properly disconnected from the engine according to the manual instructions.	Engine accessories /attachments are properly disconnected			6
	1.6. Diesel Engine is completely dismounted from the vehicle according to the repair procedures.	Diesel Engine is completely dismounted			7
Learning outcome 2: **Overhaul diesel engine (40%)**	2.1. Tools, materials, and equipment are properly selected based on the work to be done	Tools, materials, and equipment are properly selected			3
	2.2. Engine components are completely disassembled according to the repair manual	Engine components are completely disassembled			10
	2.3. Engine components are properly cleaned/inspected and checked according to the engine components initial status	Engine components are properly cleaned/inspected and checked			10
	2.4. Engine damaged components are properly adjusted/ replaced according to repair manual	Engine damaged components are properly adjusted/ replaced			7
	2.5. Engine components are methodically re-assembled according to the assembling procedures	Engine components are methodically re-assembled			10
Learning outcome 3: **Remount diesel engine (30%)**	3.1. Tools, materials, and equipment are properly selected based on the work	Tools, materials, and equipment are properly selected			3
	3.2. Engine is correctly re-mounted to the vehicle according to the repair manual	Engine is correctly re-mounted			7

	3.3. Engine accessories and attachments are properly re-connected to the engine according to user manual	Engine accessories and attachments are properly re-connected			8
	3.4. Engine fluids are correctly re-filled based on indicated level	Engine fluids are correctly re-filled			3
	3.5. Engine fuel supply system is properly bled according to the manufacturer's instructions	Engine fuel supply system is properly bled			4
	3.6. Vehicle engine performance is properly tested based on functionality.	Vehicle engine performance is properly tested			5
Total marks					**100**
Percentage Weightage					**100%**
Minimum Passing line % (Aggregate): 70%					

References:

1. Automotive technology volume principles diagnosis and services fourth edition James D. Haldman, 2012
2. Automotive technology volume a systems approach 5th edition Jack Erjavec, 2009
3. Technology of automotive trade volume 2, H. Girschler, 2011
4. Modern automotive technology Europa Lehmetel 2nd edition, 2011
5. Advanced Engine Technology [2 ed.] by HEINZ HEISLER, 2002