

10.1.0 VEHICLE TECHNOLOGY

10.1.01 INTRODUCTION

This module unit is designed to equip the trainees with knowledge, skills and attitudes to enable him acquire competencies in routine vehicle service. Upon completion of the module unit, the trainee will be able to work in a garage, for a vehicle industry or service station as an operator. The module forms a basis for all other modules to be covered in the course.

10.1.02 GENERAL OBJECTIVES

By the end of this module unit, the trainee should be able to:

- a) Understand the layout and functions of the main vehicle components
- b) Understand the sealing and locking methods to seal and lock motor vehicle components efficiently
- c) Carry out routine maintenance on motor vehicles
- d) Understand the working principle of combustion in spark and compression ignition engines
- e) Understand workshop /garage layout and operations procedures
- f) Determine the cost of a vehicle service.
- g) Observe safety in the Automotive Engineering workshop and other work places

Code	Sub-Module Unit	Content	Time Hrs		
			Theory	Pract	Total
10.1.1	Safety	<ul style="list-style-type: none">• Safety rules• First aid techniques• Classes of fire• Fire extinguishers• Flammable gases and materials.• Safe working	2	2	4

		<p>procedures.</p> <ul style="list-style-type: none"> • Factories and workplaces Act 			
10.1.2	Vehicle layout	<ul style="list-style-type: none"> • The major units • Types of vehicle • Layouts • Types of vehicle drives • Engine positions • Types of chassis 	2	8	10
10.1.3	Transmission system	<ul style="list-style-type: none"> • Major components • Functions of major components • Principles of operation of major components • Safety precautions 	8	14	22
10.1.4	Steering system	<ul style="list-style-type: none"> • Functions of the steering system • Types of steering systems • Construction of steering systems • Steering geometry terms • Principles of 	10	14	24

		<p>operation of steering systems</p> <ul style="list-style-type: none"> • Operation of steering gearboxes • Safety precautions observed in steering system 			
10.1.5	Suspension system	<ul style="list-style-type: none"> • Functions of the suspension system • Types of suspension systems • Principles of operation of suspension systems • Safety precautions observed in suspension system 	14	20	34
10.1.6	Braking system	<ul style="list-style-type: none"> • Functions of the braking system • Types of braking systems • Wheel rims • Principles of operation of braking systems • Applications 	20	50	70

		of braking systems • Safety precautions observed in braking system			
10.1.7	Wheel and tyres	• Function of wheels. • Types of wheels and tyres. • tread patterns • Tyre pressures • Tyre rotation			10
10.1.8	Driving	• Model town board • Road signs • First aid			6
Total Time			56	108	180

10.1.1 SAFETY

Practice

10.1.1T0 *Specific Objectives*

By the end of the sub module unit, the trainee should be able to:

- a) observe safety rules
- b) apply first aid techniques
- c) categorize classes of fire
- d) use different types of fire extinguishers

- e) differentiate flammable materials and gases
- f) apply safe working procedures in the workshop
- g) employ the factories and work places
Act in relation to workshop

10.1.1C *Competence*

- The trainee should have the ability to:
- i) Practice safety
 - ii) Perform first aid drill
 - iii) Perform fire fighting drill

		classes of fire using appropriate fire extinguishers
	<i>Content</i>	
10.1.1T1	Safety rules	
10.1.1T2	First aid techniques	
10.1.1T3	classes of fires Class A,B,C,D	
10.1.1T4	Fire extinguishers: i) Water ii) Carbon Dioxide iii) Foam iv) Fire Blankets v) Sand vi) Powder	
10.1.1T5	Flammable gases and materials.	
10.1.1T6	Safe working procedures.	
10.1.1T7	Factories and workplaces Act.	
	Practice	
10.1.1P0	Specific Objectives By the end of the sub module unit, the trainee should be able to: a) practice safety rules and regulations in the auto workshop b) perform first aid and first aid techniques c) classify different types of fires d) extinguish different	
		<i>Content</i>
		10.1.1P1 Safety rules and regulations
		10.1.1P2 First aid and first aid techniques i) Shock ii) Burns iii) Cut And Wounds iv) Fractures
		10.1.1P3 Classes of fire i) Class A ii) Class B iii) Class C iv) Class D
		10.1.1P4 Fire extinguishers i) Carbon dioxide ii) Foam iii) Water iv) Fire blankets v) Sand
		<i>Suggested Learning Resources</i> - Workshop safety equipment - Manuals - Journals - Charts
		10.1.2 VEHICLE LAYOUT
		Practice
		10.1.2T0 <i>Specific Objectives</i> By the end of the sub module unit, the

trainee should be able to:

- a) explain the function of the major vehicle components
- b) explain types of vehicle layouts
- c) explain types of vehicle drives
- d) explain types of engine positions
- e) differentiate types of vehicle and body chassis

10.1.2C *Competence*
 The trainee should have the ability to:

- i) Locate various vehicle parts
- ii) Design and construct the vehicle chassis

Content

10.1.2T1 Major components

- i) Engine
- ii) Transmission
- iii) Suspension
- iv) Braking
- v) Steering
- vi) Electrical system
- vii) Body

10.1.2T2 Types of vehicle layouts

- Conventional
- Alternative layout

10.1.2T3 Types of vehicle drives

- i) Rear wheel
- ii) Front wheel
- iii) Four wheel
- iv) Six wheel

10.1.2T4 engine positions

- Front engine
- Central engine
- Rear engine

10.1.2T5 Types of chassis

- Separate
- integral

Practice

10.1.2P0 *Specific Objectives*
 By the end of the sub module unit, the trainee should be able to:

- a) locate various types of vehicle units
- b) design and construct a vehicle chassis

Content

10.1.2P1 Vehicle units

- i) Engine
- ii) Transmission
- iii) Brakes
- iv) Suspension
- v) Steering
- vi) Auxiliary
- vii) Chassis

10.1.2P2 Design project
 Vehicle chassis

Suggested Learning Resources

	<ul style="list-style-type: none"> - Charts - Journals - Vehicle units - Models - Text books - Hand tools - Equipments - Materials 	<ul style="list-style-type: none"> components of the transmission ii) Observe safety
10.1.3	TRANSMISSION SYSTEM	
	Practice	
10.1.3T0	<i>Specific Objectives</i> By the end of the sub-module unit, the trainee should be able to:	
	a) name the main components of the transmission system	10.1.3T1 Major components <ul style="list-style-type: none"> i) Clutches ii) Gearboxes iii) final drive iv) Overdrive v) Propeller shaft vi) Drive shafts vii) Universal joints
	b) state the functions of the transmission components in the layout	10.1.3T2 Functions of major components
	c) explain the principles of operation of transmission components in the layout	10.1.3T3 Principle of operation of major components
	d) observe safety precautions	<ul style="list-style-type: none"> a) Clutches b) multi spring clutch c) diaphragm spring clutch d) multi plate clutch e) cone clutch f) centrifugal g) Gearboxes <ul style="list-style-type: none"> i) Sliding mesh ii) Constant mesh iii) Splitter iv) Twin layshaft v) Synchronesh vi) semi automatic vii) fluid flywheel viii) Automatic ix) Torque converter x) continuously variable transmission (CVT) h) Final drive i) pinion
10.1.3C	<i>Competence</i> The trainee should have the ability to:	
	i) repair, service and maintain	

- | | |
|--|--|
| <ul style="list-style-type: none"> ii) crown wheel i) Differential unit <ul style="list-style-type: none"> i) Planet wheel ii) Sun wheel iii) Cross pin/spider shaft iv) Differential lock j) Limited slip differential (mechanical, viscous) k) Rear axle <ul style="list-style-type: none"> i) Dead and live axle ii) Axle casing (split, banjo) iii) Axle shafts iv) Semi floating v) $\frac{3}{4}$ floating vi) Fully floating vii) Drive shafts viii) Double reduction l) Overdrive m) Propeller shaft n) Drive shafts o) Universal joints | <ul style="list-style-type: none"> b) observe safety precautions |
| <p>10.1.3T4 Safety precautions</p> | <p>10.1.3P1 Servicing various components</p> <ul style="list-style-type: none"> i) Clutches ii) Gearboxes iii) Final drive iv) Overdrive v) Universal Joints vi) Propeller shaft vii) Drive shafts <p>10.1.3P2 Observing safety precautions</p> |
| | <p><i>Content</i></p> <p><i>Suggested Learning Resources</i></p> <ul style="list-style-type: none"> - models - transmission system unit - tools - equipment - job cards - journals - manuals - charts |

Practice

- 10.1.3P0 *Specific Objectives*
 By the end of the sub module unit, the trainee should be able to:
- a) service various components of the transmission system

10.1.4 **STEERING SYSTEM**

Theory

- 10.1.4T0 *Specific objectives*
 By the end of the sub module unit, the trainee be able to:
- a) explain the functions of the steering system

- b) name various types of steering systems
- c) explain meaning of steering geometry terms
- d) explain principle of operation of various steering systems
- e) explain operation of various steering gearboxes
- f) Observe safety precautions in steering systems

10.1.4C *Competencies*

The trainee should have the ability to:

- i) diagnose steering system faults
- ii) service and repair steering systems

Content

- 10.1.4T1 Functions of vehicle steering systems
- 10.1.4T2 Types of steering systems
 - i) systems
 - ii) Manual
 - iii) Power assisted
 - iv) Power
 - v) Twin axle (four wheel) steering
- 10.1.4T3 Steering geometry terms
 - i) Ackerman principle
 - ii) Camber angle
 - iii) Caster angle
 - iv) Toe-in and toe-out

10.1.4T4 Principle of operation of various steering system

- i) Manual
- ii) Power assisted
- iii) Power
- iv) Twin axle (four wheel) steering

10.1.4T5 Operation of steering

- i) gearboxes
- ii) rack and pinion
- iii) recirculating balls
- iv) cam and peg
- v) screw and nut
- vi) worm and wheel
- vii) worm and sector
- viii) worm and roller
- ix) Application

10.1.4T6 Safety precautions

Practice

10.1.4P0 Specific objectives

By the end of the sub module unit, the trainee should be able to:

- a) Diagnose, service, and replace steering systems
- b) Observe safety precautions

Content

- 10.1.4P1 Diagnosis and servicing of steering system
 - i) Manual
 - ii) Power assisted
 - iii) Power

- iv) Twin axle (four wheel) steering

10.1.4P2 Safety precautions

Suggested Learning Resources

- Vehicle fitted with manual steering system
- Manuals
- Workshop tools and equipment

10.1.5 SUSPENSION SYSTEMS

Theory

10.1.5T0 *Specific Objectives*

By the end of the sub-module unit, the trainee should be able to:

- a) explain the function of suspension systems
- b) name various types of suspension systems
- c) describe the construction of various suspension systems
- d) explain the principle of operation of various suspensions systems
- e) observe safety precautions

10.1.5C *Competence*

The trainee should have the ability to:

- i) Diagnose faults, service and repair various types of suspension systems
 - ii) Observe safety precautions
- Content

10.1.5T1 Functions

10.1.5T2 Types

Springs

- (i) Independent suspension
- (ii) Hydraulic
- (iii) Air
- (iv) Hydra gas
- (v) Hydro pneumatic

10.1.5T3 Construction of various suspension systems

- i) Springs
- ii) Leaf springs
- iii) Coil springs
- iv) Rubber springs
- v) Independent
- vi) Front
- vii) Rear
- viii) Hydraulic
- ix) Air
- x) Hydra gas
- xi) Hydro pneumatic

10.1.5T4 Principle of operation of various suspension systems

10.1.5T5 Safety precautions

Practice

- 10.1.5P0 Specific Objectives
By the end of the sub module unit, the trainee should be able to:
- a) identify different types of suspension systems
 - b) diagnose faults, service and repair various types of suspension systems

Content

- 10.1.5P1 Identification
Springs
- i) Independent suspension
 - ii) Hydraulic
 - iii) Air
 - iv) Hydra gas
 - v) Hydro pneumatic
- 10.1.5P2 Diagnose faults, service and repair suspension systems
- i) Removal
 - ii) Refitting
 - iii) Leakage
 - iv) Noise

Suggested Learning Resources

- Charts
- Various suspension systems
- Models of suspension systems
- Workshop manuals

10.1.6 **BRAKING SYSTEMS**

Theory

- 10.1.6TO Specific Objectives
By the end of the sub-module unit, the trainee should be able to:
- a) explain the function of brakes in a vehicle
 - b) name various types of braking systems
 - c) explain the principle of operation of various types of braking systems
 - d) observe safety precautions

- 10.1.6P3 Competence
The trainee should have the ability to:
- i) identify layout of the braking systems
 - ii) diagnose fault, service and repair various types of braking systems
 - iii) observe safety
 - iv) observe safety

Content

- 10.1.6T1 Purpose of brakes
10.1.6T2 Types of braking systems
- i) Conventional braking systems

	ii) Drum brakes	xi) Eddy currents
	iii) Disc brakes	xii) Hydraulic retarders
	iv) Mechanical system	xiii) Antilock braking system (ABS)
	v) Hydraulic system	xiv) electronic
	vi) Power brakes	xv) mechanical
	vii) Vacuum assisted servo units	xvi) requirements
	viii) Hydraulic servo system	xvii) intrusive ABS
	ix) Air operated power brakes	xviii) Traction control system
	x) Auxiliary braking system	xix) Electronic brake pressure apportioning
	xi) Exhaust brakes	xx) Electronic vehicle stability control
	xii) Eddy currents	
	xiii) Hydraulic retarders	10.1.6T4 Safety
	xiv) Antilock braking system (ABS)	<i>Practice</i>
	xv) electronic	10.1.6P0 Specific Objectives
	xvi) mechanical	By the end of the sub-module unit, the trainee should be able to:
10.1.6T3	Principle of operation Conventional braking systems	a) Identify various types of braking systems
	i) Drum brakes	b) diagnose fault, service and repair various types of braking systems
	ii) Disc brakes	c) observe safety
	iii) Mechanical system	
	iv) Hydraulic system	<i>Content</i>
	v) Power brakes	10.1.6P1 Identify types of braking systems
	vi) Vacuum assisted servo units	Conventional braking systems
	vii) Hydraulic servo system	i) Drum brakes
	viii) Air operated power brakes	
	ix) Auxiliary braking system	
	x) Exhaust brakes	

- ii) Disc brakes
 - iii) Mechanical system
 - iv) Hydraulic system
 - v) Power brakes
 - vi) Vacuum assisted servo units
 - vii) Hydraulic servo system
 - viii) Air operated power brakes
 - ix) Auxiliary braking system
 - x) Exhaust brakes
 - xi) Eddy currents
 - xii) Hydraulic retarders
 - xiii) Antilock braking system (ABS)
 - xiv) electronic
 - xv) mechanical
- 10.1.6P2 Diagnose faults service and repair braking systems
- i) drum brakes
 - ii) Lining the brake shoes
 - iii) Adjustment of brakes
 - iv) disc brakes
 - v) Changing of disc pads
 - vi) Changing a worn out disc
 - vii) Replacement of rubber boots
 - viii) Hydraulic system
 - ix) master cylinder
 - x) wheel cylinder
 - xi) Bleeding
 - xii) Mechanical brakes
 - xiii) Servicing the handbrakes
 - xiv) Adjustment of the handbrake
 - xv) Power brakes
 - xvi) Direct
 - xvii) Indirect
 - xviii) Vacuum assisted brakes
 - xix) Hydraulic servo system
 - xx) Air operated power brakes
 - xxi) Auxiliary braking system
 - xxii) Exhaust brakes
 - xxiii) Eddy currents
 - xxiv) Hydraulic retarders
 - xxv) Antilock braking system (ABS)
 - xxvi) electronic
 - xxvii) mechanical
- Suggested learning resources*
- Hand tools
 - Vehicle with braking system
 - Vehicle with air operated brakes
 - Vehicle with auxiliary brakes
 - Vehicle with antilock braking system
 - Hydraulic fluid
 - Clear pipe

- Clear bottle
- Brake linings
- Brake pads
- Brake replacement parts
- Master cylinders
- Wheel cylinders
- Computer software
- Servo units
- Testing equipment
- Speed wheel sensors

10.1.7C *Competence*

The trainee should have the ability to:

- i) repair tubes, valves and tyres
- ii) practice wheel balancing using the correct machines and procedures
- iii) employ suitable tyres for various types of vehicles and road conditions

10.1.7 **WHEELS AND TYRES**

Content

Theory

- 10.1.7T0 Specific Objectives
By the end of the sub module unit, the trainee should be able to:
- a) explain the purpose of wheels in the vehicle.
 - b) identify types of tyres
 - c) explain types of rims.
 - d) explain the different types of tread pattern made on a tyre.
 - e) explain the importance of tyre inflation pressures.
 - f) explain the importance of tyre rotation.

10.1.7T1 Function of wheels.

10.1.7T2 Types of tyres.

- i) tubeless
- ii) tube type
- iii) cross ply
- iv) radial ply

10.1.7T3 Wheel rims

- i) well type
- ii) three piece
- iii) spoked

10.1.7T4 Treads patterns aquaplaning

10.1.7T5 Inflation pressures

- i) under inflation
- ii) over inflation
- iii) pressure gauges
- iv) pressure valves

10.1.7T6 Importance of tyre rotation

Practice

10.1.7P0 Specific Objectives

By the end of the sub module unit, the trainee should be able to:

- a) identify types of rims and tyres
- b) repair tubes and valves
- c) carry out wheel balancing
- d) select suitable tread patterns for given vehicles and road conditions

Content

10.1.7P1 Types of rims and tyres

- i) Tyres
- ii) Tubes
- iii) Valves
- iv) Rims

10.1.7P2 Repair and service wheels

- i) Wheel balancing
- ii) Select tread patterns

Suggested Learning Resources

- wheels
- LCD
- practical work
- tyres
- tools
- equipment
- manuals
- charts
- job cards
- journals

10.1.8 **DRIVING**

10.1.8T0 Specific Objectives

By the end of the sub module unit, the trainees should be able to:

- a) demonstration appropriate driving skills in a model town board
- b) enterprise roads signs used in Kenyan roads
- c) administer first aid to injuries in the event of an accident

10.1.8C *Competencies*

The trainee should have the ability to:

- i) Carry out routine checks.
- ii) Read and interpret road signs.
- iii) Interpret highway codes.
- iv) Start and drive a motor vehicle which observes all the regulations
- v) Drive safely on Kenyan roads
- vi) Give first aids to an injured passenger and self

Content

10.1.8T1 Model town board
 -Central island
 -Round about

- Lane drill
- Parking
- Highway code
- 10.1.8T2 Road signs
 - Regulatory
 - Hazard information
 - Facility
- 10.1.8T3 First aid
 - Burns
 - Cuts
 - Blisters

- Junctions

Suggested Learning Resources

- Model board
- Highway code
- Vehicle
- Road signs
- Model cars

Practice

- 10.1.8P0 *Specific Objectives*
 By the end of the sub-module unit, the trainees should be able to:
- a) take off from rest and move to other gears
 - b) reverse a vehicle
 - c) park a vehicle
 - d) maintain the correct lane while driving

easytvvet.com

Content

- 10.1.8P1 Driving from rest
Gear 1,2,3,4,and 5;
hill start
- 10.1.8P1 Reversing
3 point turn
- 10.1.8P2 Use of driving mirror
- 10.1.8P3 Parking
 - Angle parking
 - Flush parking
- 10.1.8P4 Lane drill
 - Lanes
 - Roundabout