

26.3.0 AUTO ELECTRIC AND ELECTRONIC

26.3.01 Introduction

The automotive industry is currently one of the most dynamic in terms of technology, and in recent years vehicle operations have greatly moved from manual to electric and/or automatic. To address these needs, this module unit is designed with knowledge skills and attitudes to enable trainees diagnose, repair and service electric and electronic systems as employees of the formal or informal industry upon completion of their training.

26.3.02 General Objectives

- By the end of the module unit the trainee should be able to:
- understand various types of vehicle ignition systems
 - apply the knowledge of control engineering in vehicle control,
 - measurement and gauge systems
 - install service, diagnose and repair faults in vehicle electrical and
 - electronic systems
 - appreciate emerging technology in the auto electrical and electronic systems
 - observe health, environment and safety while working in a
 - vehicle electrical and electronic workshop and other work places

26.3.03 Module Unit Summary and Time Allocation

Auto Electric and Electronic

Code	Sub Module Unit	Content	Time Hrs		
			T	P	Total
26.3.1	Vehicle ignition systems	<ul style="list-style-type: none">Types of ignition systemsOperation principles of ignition systems	8	14	22
26.3.2	Charging System	<ul style="list-style-type: none">Charging circuit principlesParts of charging system	4	4	8
26.3.3	Light Duty Starter	<ul style="list-style-type: none">Layout of starting system:	2	6	8

	Motors	<ul style="list-style-type: none"> • Types of Stator motors • Construction • Starter motor operation 			
26.3.4	Heavy Duty Starter Motors	<ul style="list-style-type: none"> • Construction • Principle of operation 	4	12	16
26.3.5	Lighting System	<ul style="list-style-type: none"> • Lamp construction • Lighting system layout 	4	12	16
26.3.6	Vehicle Gauges	<ul style="list-style-type: none"> • Fuel Gauge • Oil Pressure Gauge • Coolant Levels Gauges • Engine Tachometer • Temperature Gauge 	8	14	22
26.3.7	Heating and Ventilation	<ul style="list-style-type: none"> • Constructional features • Principle of operation 	6	6	12
26.3.8	Air Conditioning	<ul style="list-style-type: none"> • Construction • Operation of system • Operation of electric control system 	6	6	12
26.3.9	Windscreen Wipers	<ul style="list-style-type: none"> • Types of windscreen wipers • Principle of operation of windscreen wipers 	2	4	8
26.3.10	Window Systems and Door Mirrors	<ul style="list-style-type: none"> • Heated door mirrors • Heated windows • Electrically operated door mirrors 	2	6	8

		<ul style="list-style-type: none"> Electrically operated window 			
26.3.1 1	Horns	<ul style="list-style-type: none"> Types of horns Electrical horns 	2	2	4
26.3.1 2	Direction Indicators	<ul style="list-style-type: none"> flasher units Operation of direction indicators 	2	2	4
26.3.1 3	Vehicle Entertainment System	<ul style="list-style-type: none"> Entertainment units Functions of vehicle entertainment unit 	2	8	10
26.3.1 4	Vehicle Air Bags	<ul style="list-style-type: none"> Vehicle internal auxiliaries Types of air bags Air bag control unit 	2	2	4
26.3.1 5	Central Door Locking System	<ul style="list-style-type: none"> Types of central door locking systems Central locking circuit 	2	4	6
26.3.1 6	Security Alarm Systems	<ul style="list-style-type: none"> Operation Types of alarm systems 	2	4	6
26.3.1 7	Engine Immobilizers	<ul style="list-style-type: none"> Functions of Engine immobilizers Operation of engine immobilizers 	2	4	6
26.3.1 8	Petrol Injection	<ul style="list-style-type: none"> Petrol injection systems Pressure Sensed Petrol Injection System Bosch L-Jetronic Functions of electronic 	8	10	12

		<p>control unit (ECU)of an engine</p> <ul style="list-style-type: none"> • Extra control circuits of an ECU 			
26.3.19	Compression Ignition Fuel System Electronic Diesel Control (E D.C.)	<ul style="list-style-type: none"> • E D.C. sensors and actuators • E D.C. system components • Secondary control 	2	4	6
26.3.20	Engine Management Systems	<ul style="list-style-type: none"> • Engine management system • System analysis • Control systems • System modelling • System performance 	2	6	8
26.3.21	Engine Mapping	<ul style="list-style-type: none"> • Engine mapping • Engine maps 	2	4	4
26.3.22	Vehicle Control systems	<ul style="list-style-type: none"> • Open loop systems • Closed loop systems 	4	4	8
26.3.23	Sensors And Actuators Used In Transmission System	<ul style="list-style-type: none"> • Types of sensors • Principle of operation of sensor and actuators 	8	4	12
26.3.24	Clutch Electronic Control	<ul style="list-style-type: none"> • Principle of operation • Layout of the clutch electronic control 	2	4	6
26.3.25	Manual Gear Box Electronic Control	<ul style="list-style-type: none"> • Layout of manual gear box electronic • Operation of 	2	4	4

		manual gear box electronic control			
26.3.2 6	Fuel Pump	<ul style="list-style-type: none"> • Operation • Construction 	2	4	4
Total Time			92	15 4	236

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26.3.1 VEHICLE IGNITION SYSTEMS

Theory

26.3.1T0 *Specific Objectives*

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

- a) name the various types of ignition systems
- b) explain the operating principle of various vehicle ignition systems
- c) describe the construction of various components of coil
- d) ignition system.

26.3.1C **Competence**

The trainee should have the ability to:

- i) Diagnose and repair faults for various vehicle ignition systems
- ii) Test various vehicle ignition systems

Content

26.3.1T1 Types of ignition systems

- i) Coil ignition
- ii) Magneto ignition
- iii) Transistor assisted ignition
- iv) Electronic ignition
- v) Capacitor discharge ignition

26.3.1T2 Operating principle of ignition systems

- i) Coil ignition

- Primary and secondary coils
- Contact breaker points
- Condenser
- Spark plugs
- Distributor
- Battery
- High tension leads
- Switch
- Operation

ii) Magneto ignition

- Electro magnets
- Spark plug
- Coils
- Flywheel
- Cam
- Operation

iii) Transistor assisted ignition

- Contact breaker points
- Transistor
- Coil
- Resistor
- Operation

iv) Electronic ignition

- Pulse generators
- inductive
- hall effect
- optical
- Operation

v) Capacitor discharge ignition

- Ignition system operation
- Pulse generator
- Pulse transformer
- Operation

Practice

26.3.1P0 *Specific Objectives*

By the end of the sub

module unit, the trainee should be able to diagnose and repair faults in various vehicle ignition systems

Content

26.3.1P1 Fault diagnosis, repair and service

- i) Coil ignition
 - Primary and secondary coils
 - Contact breaker points
 - Condenser
 - Spark plugs
 - Distributor
 - Battery
 - High tension leads
 - Switch
 - Testing
- ii) Magneto ignition
 - Electro magnets
 - Spark plug
 - Coils
 - Flywheel
 - Cam
 - Operation
- iii) Transistor assisted ignition
 - Contact breaker points
 - Transistor
 - Coil
 - Resistor
 - Testing
- iv) Electronic ignition
 - Testing
 - Repair
- v) Capacitor discharge ignition
 - Pulse generator
 - Pulse transformer
 - Testing

Suggested Learning Resources

- i) Multimeter
- ii) Vehicles fitted with various types of ignition systems
- iii) Vehicle manuals
- iv) Text books
- vi) Charts
- vii) Hand outs
- viii) Coil ignition system components

26.3.2 CHARGING SYSTEM

Theory

26.3.2T0 *Specific Objectives*

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

- a) identify the various parts of the charging circuit.
- b) describe the construction and operation of a vehicle charging system

26.3.2 Competence

The trainee should have the ability to:

- i) explain the operation of a charging system .
- ii) diagnose and repair faults in a charging system

Content

26.3.2T1 Charging circuit

- principles
- i) Dynamo
 - ii) Alternator
- 26.3.2T2 Parts of charging system
- i) Generator/dynamo/alternators
 - ii) Rectifier
 - iii) Regulator
 - iv) Battery
 - v) Switch

Practice

- 26.3.2P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) identify the various parts of a vehicle charging system
 - b) dismantle the various parts of a vehicle charging system
 - c) diagnose and assemble and repair faults in the charging system

Content

- 26.3.2P1 Parts of a charging system
- i) Stator
 - ii) rotor
 - iii) Rectifier, regulator
 - iv) Inspection of charging system
 - v) Faults diagnosis and repair
- 26.3.2P2 Dismantling and assembly
- 26.3.2P3 Diagnoses and repair of faults

Suggested Learning Resources

- i) Projectors
- ii) Charts
- iii) Starting motors
- iv) Tools and equipment workshop manuals
- v) Data charts
- vi) Various parts of charging system
- vii) Battery
- viii) alternator
- ix) Dynamos
- x) Cables
- xi) Multimeter

26.3.3 LIGHT DUTY STARTER MOTORS

Theory

- 26.3.3T0 *Specific Objectives*
By the end of the sub-module unit the trainee should be able to:
- a) describe the layout of a starting system
 - b) name various types of starter motors
 - c) explain the principle of operation of different types of stator motors
 - d) describe the construction of various starter motor

Content

- 26.3.3T1 Layout of starting system:
- 26.3.3T2 Types of Stator motors
- i) Pre-engaged

- ii) Inertia
- 26.3.3T3 Starter motor operation
- 26.3.3T4 Construction
 - i) Armature
 - ii) Solenoid switch
 - iii) Pinion gear
 - iv) Ring gear

Practice

- 26.3.3P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to diagnose, service and maintain different types of starter motors

Content

- 26.3.3P1 Diagnoses and maintenance of starter motors
 - i) Service
 - ii) overhaul
 - iii) Tests

Competence

- The trainee should have the ability to:
- i) explain operation of light duty starter motors
 - ii) diagnose service and maintain starter motors

Suggested Learning Resources

- i) Text books
- ii) hand outs
- iii) Starter motors
- iv) multimeter
- v) battery
- vi) spring balance
- vii) workshop tools

26.3.4 HEAVY DUTY STATER MOTORS

Theory

- 26.3.4T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

- a) explain the principle of operation of different types of heavy duty starter motors
- b) describe the construction of different types of heavy duty starter motors

26.3.4C Competence

- The trainee should have the ability to explain the:
- i) operation of heavy duty diagnose, service and maintain starter motors
 - ii) diagnose, service and maintain starter motors

Content

- 26.3.4T1 Principle of operation
 - i) Coaxial (sliding gear)
 - ii) Axial (sliding armature)
 - iii) 26.3.8T2 Construction
 - iv) Coaxial
 - v) Axial

vehicle lamps.

Practice

- 26.3.4P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to diagnose, service and maintain different types of starter motors

Content

- 26.3.4P1 Service and maintenance
i) Service
ii) overhaul
iii) Tests

Suggested Learning Resources

- i) Text books
- ii) Hand outs
- iii) Charts
- iv) Starter motors
- v) multimeter
- vi) battery
- vii) spring balance
- viii) workshop tools

26.3.5 LIGHTING SYSTEM

Theory

- 26.3.5T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) identify the various types of lighting system layouts
 - b) describe the construction and operation of different types of

26.3.5C Competence

The trainee should have the ability to:

- i) to explain operation of different lighting system layout
- ii) describe the construction of different types of lamps
- iii) diagnosis service and repair vehicle lighting system

Content

- 26.3.5T1 Lighting system layout
26.3.5T2 Lamp construction

Practice

- 26.3.5P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) identify the various vehicle lighting system circuits
 - b) diagnose and repair faults of the vehicle lighting systems

Content

- 26.3.5P1 Vehicle lighting circuits
i) Types of lamps
ii) Beam setting
iii) Manual
iv) Optical

v) Switches
26.3.5P2 Diagnosis and fault repair

Suggested Learning Resources

- i) circuit diagrams
- ii) flow charts
- iii) audio visual system
- iv) circuit boards
- v) different types of lamps
- vi) Vehicle lighting system testing kits
- vii) Workshop manuals
- viii) Battery
- ix) Workshop tools

26.3.6 VEHICLE GAUGES

Theory

- 26.3.6T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) describe the construction and operation of different types of fuel gauges
 - b) describe the construction and operation of different types of oil gauges
 - c) describe the construction and operation of different types of coolant level gauges
 - d) describe the construction and operation of

- e) engine tachometer
- e) describe the construction and operation of different temperature of fuel gauges

26.3.6C Competence

The trainee should have the ability to diagnose, service and repair faults in various vehicle gauges

Content

- 26.3.6T1 fuel gauges
 - i) Electric
 - ii) Electronic
 - iii) Thermal
- 26.3.6T2 oil gauges
 - i) electric (thermal type)
 - ii) electronic (piezo resistor)
 - iii) Thermal type
 - iv) Piezo resistor
- 26.3.6T3 Coolant level gauges
 - i) electrical
 - ii) electronic
- 26.3.6T4 Engine tachometer
 - i) induction
 - ii) optical
 - iii) electrical
 - iv) electronic

Practice

- 26.3.6P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
- a) diagnose, service and repair faults in fuel gauges

- b) diagnose, service and repair faults in coolant level gauges
- c) diagnose and repair faults related to engine tachometer
- d) diagnose and repair faults related to a temperature gauge

- iv) Multi tester
- v) Workshop tools
- vi) Fuel gauges
- vii) Oil gauges
- viii) Coolant gauge
- ix) a vehicle fitted with a tachometer
- x) Temperature gauges
- f) describe the construction of various types of oil/pressure gauges

Content

- 26.3.6P1 Fuel gauges
 - i) Diagnose
 - ii) Service
 - iii) Repair faults
- 26.3.6P2 Coolant level gauges
 - i) Diagnose
 - ii) Service
 - iii) Repair faults
- 26.3.6P3 Engine tachometer
 - i) Trouble shooting
 - ii) Remove/service
 - iii) Cleaning
 - iv) Inspecting
 - v) Replacing faulty tachometer
 - vi) Removing (old)
 - vii) Installing (a new one)
 - viii) Testing for workability
- 26.3.6P4 Temperature gauges
 - i) Diagnose
 - ii) Service
 - iii) Repair faults
 - iv) testing

Suggested Learning Resources

- i) Text books
- ii) Charts
- iii) Fuel gauges

Content

- a) ven oil pressure gauge

Suggested Learning Resources

- i) Textbooks
- ii) Lectures

26.3.7 HEATING AND VENTILATION

Theory

26.3.7T0 *Specific Objectives*

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

- a) describe the construction of a heating and ventilating system
- b) explain the operation of a heating and ventilating system in a vehicle

26.3.7C Competence

The trainee should have the ability to:

- i) identify components of a heating and ventilating system.
- ii) diagnose and repair faults in a heating and ventilating system

iii) Vehicle fitted with heating and ventilating system

26.3.8 AIR CONDITIONING

Theory

26.3.8T0 *Specific Objectives*

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

- a) define air conditioning system of a vehicle.
- b) describe the construction of an air conditioning system of a vehicle.
- c) explain the operation of an air conditioning system of a vehicle of the electric control system.

Content

26.3.7T1 Constructional features

- i) Resistor block
- ii) Fan
- iii) Switches
- iv) Circuitry

26.3.7T2 Operation

Practice

26.3.7P0 *Specific Objectives*

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

- a) identify the components of a heating and ventilating system.
- b) diagnose faults in a heating and ventilating system

26.3.8C **Competence**

The trainee should have the ability to diagnose and service air conditioning system

Content

26.3.7P1 Identification of:

- i) motor
- ii) resistor block
- iii) fan
- iv) switches
- v) blower
- vi) doors

26.3.7P2 Fault diagnosis

Content

26.3.8T1 Construction

- i) evaporator
- ii) heater blower motor
- iii) condenser
- iv) pump
- v) drier
- vi) piping

Suggested Learning Resources

- i) Voltmeter
- ii) Manual

- vii) operation of system
- 26.3.8T2 Operation of system
- 26.3.8T3 Operation of electric control system

Suggested Learning Resources

- i) Text books
- ii) Charts
- iii) Internet

Practice

- 26.3.8P0 *Specific Objectives*
By the end of sub-module unit, the trainee should be able to:
 - a) identify components of an air conditioning system
 - b) diagnose faults in an air-conditioning system

Content

- 26.3.8P1 Identification of air conditioning components
- 26.3.8P2 Fault diagnoses in air conditioning systems

Suggested Learning Resources

- i) Charts
- ii) Manuals
- iii) Air condition system

26.3.9 WINDSCREEN WIPERS

Theory

- 26.3.9T0 *Specific Objectives*
By the end of this sub module unit, the

trainee should be able to:

- a) explain the principle of operation of windscreen wipers
- b) list different types of windscreen wipers

26.3.9C Competence

The trainee should have the ability to:

- i) service the windscreen system
- ii) diagnose and repair faults in the windscreen system

Content

- 26.3.9T1 Principle of operation of windscreen wipers
- 26.3.9T2 Types of windscreen wipers
 - i) Permanent magnet
 - ii) Mechanical

Practice

- 26.3.9P0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:
 - a) identify different types of wiper systems
 - b) replace wiper blades
 - c) detect motor faults
 - d) test the wiper system

Content

- 26.3.9P1 Wiper blades

- 26.3.9P2 Wiper arms
- 26.3.9P3 Wiper faults
- 26.3.9P4 Motor faults

Suggested Learning Resources

- i) Wiper system
- ii) Multimeter
- iii) Manuals
- iv) Charts
- v) Hand outs
- vi) Text books

26.3.10 WINDOW SYSTEMS AND DOOR MIRRORS

Theory

26.3. 10T0 *Specific Objectives*

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

- a) explain the principle of operation of window winding.
- b) state different types of windows
- c) explain the principle of operation of door mirrors.
- d) state different types of door mirrors

26.3. 10C Competence

The trainee should have the ability to diagnose and repair faults in window and door systems.

Content

- 26.3. 10T1 Electrically

operated window

- 26.3. 10T2 Heated windows

- 26.3. 10T3 Electrically operated door mirrors

- 26.3. 10T4 Heated door mirrors

Practice

26.3. 10P0 *Specific Objectives*

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

- a) detect motor faults
- b) diagnose faults in the window winding system
- c) diagnose faults in door mirror systems
- d) embrace emerging technology in vehicle electrical and electronic control systems

Content

- 26.3.10P1 Electrically operated window

- 26.3. 10P2 Heated windows

- 26.3. 10P3 Electrically operated door mirrors

- 26.3. 10P4 Heated door mirrors

Suggested Learning Resources

- i) Manuals
- ii) Window systems
- iii) Door systems
- iv) Multimeter
- v) Hand outs
- vi) Charts
- vii) Text books

viii) Internet

26.3.11 HORNS

Theory

26.3.11T0 *Specific Objectives*

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

- a) explain the principle of operation of horns
- b) describe the construction of different types of horns.

26.3.11C **Competence**

The trainee should have the ability to:

- i) install different types of horns
- ii) diagnose faults and service different types of horns

Content

26.3.11T1 Horn system

26.3.11T2 Types

- i) high frequency
- ii) air horn
- iii) windrone

Practice

26.3.11P0 *Specific Objectives*

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

- a) identify different

- b) types of horns
- b) diagnose faults and service different types of horns

Content

26.3.11P1 Electrical horns

26.3.11P2 Types of horns

- i) high frequency
- ii) air horn
- iii) windrone

Suggested Learning Resources

- i) different types of horns
- ii) multimeter
- iii) repair kit
- iv) Hand outs
- v) Text books
- vi) Horns
- vii) Battery
- viii) Electrical connectors and wires

26.3.12T0 **DIRECTION INDICATORS**

Theory

26.3.12T0 *Specific Objectives*

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

- a) explain the principle of operation of direction indicator
- b) list different types of flasher units

26.3.12C **Competence**

The trainee should have the ability to service direction

indicators.

Content

26.3.12T1 Operation of direction indicators

26.3.12T2 flasher units

- i) thermal
- ii) capacitor
- iii) electronic

Practice

26.3.12P0 *Specific Objectives*

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

- a) select and use different types of flasher units
- b) diagnose faults and service direction indicators

Content

26.3.12P1 Flasher unit types:

- i) thermal
- ii) capacitor
- iii) electronic

26.3.12P2 direction indicator

Suggested Learning Resources

- i) direction indicators
- ii) flasher unit
- iii) battery
- iv) electrical connectors and wires
- v) Multi meter
- vi) Horn repair kit
- vii) Text books
- viii) Charts
- ix) Hand outs

26.3.13 VEHICLE ENTERTAINMENT SYSTEM

Theory

26.3.13T0 *Specific Objectives*

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

- a) list different types of entertainment units of a vehicle
- b) describe the functions of different types of vehicle entertainment units

26.3.13C Competence

The trainee should have the ability to:

- i) operate vehicle entertainment units.
- ii) fit vehicle entertainment units
- iii) diagnose and repair faults in vehicle entertainment units

Content

26.3.13T1 Entertainment units

- i) Radio
- ii) CD players
- iii) DVD players
- iv) In car telephones
- v) Television

26.3.13T2 Functions of vehicle entertainment unit

Practice

26.3.13P0 *Specific Objectives*

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

- a) select and use different types of vehicle entertainment units.
- b) fit different types of vehicle entertainment units.
- c) operate different types of vehicle entertainment units.
- d) diagnose faults in vehicle entertainment units

Content

26.3.13P1 Entertainment units

- i) radio
- ii) CD players
- iii) DVD players
- iv) In car telephones
- v) television

26.3.13P2 Fault diagnosis and repair

Suggested Learning Resources

- i) Charts Hand outs
- ii) Text books
- iii) Internet
- iv) Multimeter
- v) Repair kits
- vi) Manuals

26.3.14 VEHICLE AIR

BAGS

Theory

26.3.14T0 *Specific Objectives*

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

- a) describe the function of an air bag
- b) list types of air bags
- c) explain the operation of the air bag control unit

26.3.14C Competence

The trainee should have the ability to diagnose faults in air bags.

Content

26.3.14T1 Vehicle internal auxiliaries

- functions of an air bag

26.3.14T2 Types of air bags

26.3.14T3 Air bag control unit

Practice

26.3.14P0 *Specific Objectives*

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

- a) locate position of the air bag
- b) diagnose and repair faults in vehicle air bags

Content

26.3.14P1 Air bags

- 26.3.14P2 Types of air bags
 - electronic
 - all – mechanical
- 26.3.14P3 Air bag control
- 26.3.14P4 Diagnosis and repair

- i) Electromagnet
 ii) Pneumatic
- 26.3.15T2 Central locking circuit

Suggested Learning Resources

- i) Video
 ii) Text books
 iii) Internet
 iv) Vehicle fitted with air bag
 v) Diagnostic kit

26.3.15 CENTRAL DOOR LOCKING SYSTEM

Theory

26.3.15T0 *Specific Objectives*
 By the end of the sub module unit, the trainee should be able to:

- a) explain the principle of operation of a central door locking system
 b) list different types of door locking systems

26.3.15C Competence

The trainee should have the ability to diagnose faults and service central door-locking systems

Content

26.3.15T1 Types of central door locking systems

Practice

26.3.15P0 *Specific Objectives*

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

- a) identify different types of central door locking systems
 b) diagnose faults in door – locking systems
 c) service door - locking systems

Content

26.3.15P1 Types of central door locking systems
 i) Electromagnet type
 ii) Pneumatic type

Suggested Learning Resources

- i) Central door locking systems
 ii) Multimeter
 iii) Manual
 iv) Charts Hand outs
 v) Text books
 vi) Internet

26.3.166 SECURITY ALARM SYSTEMS

Theory

26.3.16T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

- a) list different types alarm systems
- b) explain operation of different types of alarm systems

26.3.16C Competence

The trainee should have the ability to:

- i) Fit security alarm system
- ii) Service security alarm system

Content

26.3.16T1 Types of alarm systems

- i) Voltage drop or current drain
- ii) Direct earth contact
- iii) Infra red
- iv) Infra red
- v) Ultrasonic
- vi) Shock sensor
- vii) Level reference
- viii) Monitor

26.3.16T2 Operation

Practice

26.3.16P0 *Specific Objectives*

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

- a) identify different types of security systems
- b) fit different types

of security alarm systems

- c) service different types of vehicle alarm system

Content

26.3.16P1 Types of alarm systems

26.3.16P2 fitting of security systems

26.3.16P3 Service and maintenance

Suggested Learning Resources

- i) Internet
- ii) Multimeter
- iii) Alarm systems
- iv) Manual
- v) Text books

26.3.17 ENGINE IMMOBILIZERS

Theory

26.3.17T0 *Specific Objectives*

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

- a) describe the function of an engine immobilizer
- b) explain the operation of an engine immobilizer

26.3.17C Competence

The trainee should have the ability to:

- i) select and use components of immobilizer system
- ii) fit an immobilizer

- system
- iii) diagnose and repair faults in an immobilizer system

- i) Text books
- ii) Internet
- iii) Hand outs
- iv) Immobilizer system
- v) Manual

Content

- 26.3. 17T1 Engine immobilization
 - i) Isolating system
 - ii) System activation
- 26.3. 17T2 Operation

Practice

- 26.3. 17P0 *Specific Objectives*

- By the end of the sub-module, the trainee should be able to:
- a) identify the components of an engine immobilizer unit
 - b) activate an immobilizer system
 - c) fit an immobilizer system
 - d) diagnose and repair faults in an immobilizer system

Content

- 26.3. 17P1 Components of an engine immobilizer unit
- 26.3. 17P2 Activation of an immobilizer system
- 26.3. 17P3 Fitting of an immobilizer system
- 26.3. 17P4 Fault diagnosis and repair

Suggested Learning Resources

26.3.18 PETROL INJECTION

Theory

26.3.18T0 *Specific Objectives*

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

- a) explain the operation of different petrol injection systems
- b) explain the operation of a pressure sensed petrol injection systems of a vehicle
- c) explain the operation of a Bosch L-Jetronic
- d) explain the functions of electronic control unit (ECU) of an engine
- e) describe the extra control circuits of an ECU

26.3. 18C Competence

The trainee should have the ability to:

- i) identify different types of petrol injection systems
- ii) diagnose and repair faults in different types of

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- petrol injection systems
- iii) operation of a pressure sensed petrol injection systems
- iv) carry out general maintenance of fuel injection system
- v) carry out a diagnostic test on a fuel injection system

Content

- 26.3. 18T1 Petrol injection systems
 - i) Electronic systems
 - Lucas type
 - ii) Ke-jetronic,
 - iii) L-jetronic
- 26.3. 18T2 Pressure sensed petrol injection systems
 - i) Manifold Absolute Pressure (MAP)
- 26.3. 18T3 Bosch L-Jetronic
 - i) vane or flap
 - ii) hot wire
- 26.3. 18T4 Electronic Control Unit (ECU)
 - i) digital control
 - ii) Operation
- 26.3. 18T5 Extra Control Circuits
 - i) cranking enrichment
 - ii) after start enrichment
 - iii) hot start enrichment and deceleration weakening
 - iv) full load enrichment
 - v) over-run fuel cut off

- vi) idle speed control

Practice

26.3. 18P0 *Specific objectives*

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

- a) identify different types of petrol injection systems
- b) diagnose and repair faults in various types of petrol injection systems
- a) perform general maintenance of an electronic fuel injection system
- c) perform a full diagnostic test an electronic petrol injection system

Content

- 26.3. 18P1 Identification of different types of petrol injection systems
- 26.3. 18P2 Diagnoses and repair of various types of petrol injection systems
- 26.3. 18P3 General maintenance
 - i) electrical connection
 - ii) fuel lines
- 26.3. 18P4 Diagnostic test
 - i) Test equipment
 - ii) Break out box
 - iii) Multimeter tests

Suggested Learning Resources

- i) Internet
- ii) Manuals
- iii) Charts
- iv) Text book
- v) Vehicle/engine fitted with pressure sensed petrol injection system
- i) Vehicle fitted with electronic petrol injection system
- ii) Multimeter
- vi) Test equipment

26.3.19 COMPRESSION IGNITION FUEL SYSTEM, ELECTRONIC DIESEL CONTROL (E D.C.)

26.3.19T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

- a) name various electronic sensors and actuators of a E D.C. system
- b) explain the operation of the components of E D.C. system
- c) describe the function of secondary control sensors in an E D.C. system.

Content

- 26.3. 19T1 E D.C. sensors and actuators
- i) fuel quantity
 - ii) start of injection
 - iii) quantity of exhaust

- iv) gas recirculate
 - iv) turbocharger boost
- 26.3. 19T2 E D.C. system components
- i) fuel injection
 - ii) quantity servo potentiometer
 - iii) needle lift sensor
 - iv) mass air flow sensor
 - v) coolant temperature sensor
 - vi) intake air temperature

26.3. 19T3 Secondary control sensors

- i) manifold absolute pressure sensor
- ii) Coolant temperature sensor
- iii) Intake air temperature sensor
- iv) Vehicle speed sensor

Suggested Learning Resources

- i) Charts
- ii) Hand outs
- iii) Text books
- iv) Manuals
- v) Vehicle/engine fitted with electronic diesel control system

26.3.20 ENGINE MANAGEMENT SYSTEMS

26.3.20T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able:

- a) explain the function of an engine management system.
- b) carry out an analysis and study of system function and performance respectively.
- c) describe system modelling
- d) list down different types of control systems

26.3. 20C Competence

The trainee should have the ability to:

- i) analyze system
- ii) study system

Content

- 26.3. 20T1 Engine management system
- 26.3. 20T2 System analysis
- 26.3. 20T3 System modelling
- 26.3. 20T4 Control systems
 - open – loop control
 - closed – loop control

Suggested Learning Resources

- i) Internet
- ii) Charts
- iii) Internet
- iv) Journals
- v) Manual
- vi) Handouts

26.3.21 ENGINE MAPPING

26.3.21T0 *Specific Objectives*
By the end of the sub module unit, the

trainee should be able:

- a) define engine mapping
- b) describe various types of engine maps

Content

- 26.3. 21T1 Engine mapping
 - Characteristic map
- 26.3. 21T2 Engine maps
 - i) Speed
 - ii) Load (throttle opening)
 - iii) Ignition timing
 - iv) Air/fuel ratio
 - v) Engine and ambient temperatures

Competence

The trainee should have the ability to:

- i) define engine mapping
- ii) describe various types of engine maps

Suggested Learning Resources

- i) Text books
- ii) Charts
- iii) Hand outs
- iv) Internet

26.3.22 VEHICLE CONTROL SYSTEMS

26.3.22T0 *Specific Objectives*
By the end of the sub module unit, the trainee should be able to:

- a) describe the vehicle open loop control systems
- b) describe the

vehicle closed loop control systems

- 26.3. 22TC *Competence*
The trainee should have the ability to apply open and closed loop control systems in vehicle electrical and electronic control systems.

Content

- 26.3. 22T1 Open loop control systems
i) Ignition timing control
ii) Fuel mixture control
- 26.3. 22T2 Closed loop control systems
i) ignition control
ii) closed loop dwell angle control

Suggested Learning Resources

- i) Internet
- ii) Text book
- iii) Hand outs
- iv) Charts
- v) Manuals

26.3.23 SENSORS AND ACTUATORS USED IN TRANSMISSION SYSTEM

Theory

- 26.3.23T0 *Specific Objectives*
By the end of the sub-module, the trainee should be able:
a) list different types of sensors used in

transmission system.

- b) describe principles of operation of sensors and actuators used transmission

26.3.23C Competence

- The trainee should have the ability to:
- i) Diagnose faults and service different types of sensors and actuators
 - ii) Test different types of sensors and actuator

Content

- 26.3. 23T1 Types of sensors
i) speed sensors
ii) temperature sensors
iii) position sensors
vi) pressure sensors
vii) Drive Train Torque Sensor
viii) Actuators
ix) Electro hydraulic actuators
- 26.3. 23T2 Principle of operation of sensor and actuators

Suggested Learning Resources

- i) Handouts
- ii) Charts
- iii) books
- iv) Internet

Practice

- 26.3. 23P0 *Specific Objectives*
By the end of the sub

module unit, the trainee should be able:

- a) identify different types of sensor and actuators
- b) diagnose faults and service different types of sensor and actuator
- c) test different types of actuator and sensor in transmission system

Content

- 26.3. 23P1 Type of sensors
 - i) temperature speed
 - ii) indirect sensors signals
 - iii) Electro hydraulic actuators
 - iv) electro actuators
- 26.3. 23P2 Diagnosing faults in sensor and actuators
 - Servicing sensor actuators
- 26.3. 23P3 Testing different types of sensor and actuators

Suggested Learning Resources

- i) Engine workshop manual
- ii) Engine analysis multi-motor
- iii) Tool kit

26.3.24 CLUTCH ELECTRONIC CONTROL

Theory

26.3.24T0 *Specific Objectives*

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

- a) explain the layout of clutch electronic control
- b) state the principle of operation of a clutch electronic control

26.3.24C Competence

The trainee should have the ability to diagnose faults and service clutch electronic control system.

Content

- 26.3. 24T1 Layout of the clutch electronic control
- 26.3. 24T2 Principle of operation

Suggested Learning Resources

- i) Hand out
- ii) Charts
- iii) Books

Practice

26.3. 24P0 *Specific Objectives*

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

- a) identify parts of a clutch electronic control
- b) service clutch electronic control

unit

Content

26.3. 24P1 Parts of clutch electronic control system

26.3. 24P2 Service of clutch electronic control system

Suggested Learning Resources

- i) Manuals
- ii) Tool kit
- iii) Diagnostic machine
- iv) Clutch electronic control unit

26.3.25 MANUAL GEAR BOX ELECTRONIC CONTROL

Theory

26.3.25T0 Specific Objectives

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

- a) explain the layout of manual electronic control system
- b) outline the principles of operation of manual gear box control system

26.3. 25C Competence

The trainee should have the ability to service and test manual gear box electronic control system.

Content

26.3. 25T1 Layout of manual gear box electronic

26.3. 25T2 Operation of manual gear box electronic control

Suggested Learning Resources

- i) Hand out
- ii) Charts
- iii) Books
- iv) Internet
- v) Audio visuals

Practice

26.3. 25P0 Specific Objectives

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

- a) identify the manual gear box electronic control system
- b) service manual gear box electronic control system

Content

26.3. 25P1 Parts of manual gear box electronic control system

26.3. 25P2 Servicing manual gear electronic control system

Suggested Learning Resources

- i) Diagnostic kit
- ii) Transmission system
- iii) Tool kit

26.3.26 FUEL PUMP

Theory