RTB | RWANDA TVET BOARD

RQF LEVEL 5

TRADE: ELECTRONIC SERVICES

Module code: ELSFG501

TEACHER'S GUIDE

Module Name: REPAIRING FUNCTION GENERATOR

Table of content

Contents

Acronyms

AC: Alternating Current

ADC: Analog to Digital Converter

BPF: Band-Pass Filter

DAC: Digital to Analog Converter

Db: Decibel

DC: Direct Current

DM: Digital Multimeter

ELS: Electronic Services

EMC: Electromagnetic Compatibility

ESD: Electrostatic – Discharge

FG: Function Generator

ICs: Integrated Circuits

IGBT: Insulated-Gate Bipolar Transistor

PCB: Printed Circuit Board

RFID: Radio Frequency Identification

UPS: uninterruptable Power Supply

USB: Universal Serial Bus

Introduction

A function generator is a test and measuring device, which creates electronic signals in many different waveforms. The generator's main purpose, when connected to a circuit, is to produce controllable waveforms with adjustable frequencies, amplitude outputs, or DC offsets. Function generators help to save time in building oscillators when you are fabricating prototype audio circuits or low and high-pass filters.

Function generators produce a range of different waveforms, such as sine waves, triangular waves; saw tooth waves and square waves. The signal generator can produce repetitive signals and can change some characteristics of the wave. You can view the signals generated by the device by attaching it to an oscilloscope. Function generators may provide other functions, such as DC offset and variable symmetry. There is usually a screen on the generator, which displays the monitoring of the output.

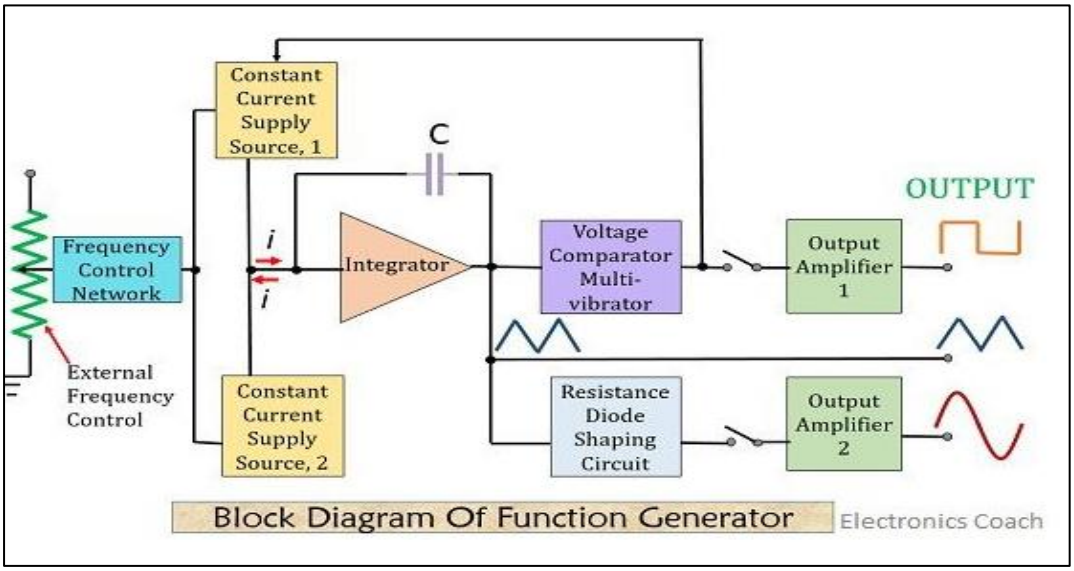
Module code: ELSFG501

Module name: REPAIRING FUNCTION GENERATOR

Learning Units:

1. Prepare the Function generator work
2. Rectify Function generator faults
3. Document the work done

LEARNING UNIT 1: PREPARE THE FUNCTION GENERATOR REPAIR WORK



STRUCTURE OF LEARNING UNIT I

Learning outcomes:

1.1: Select the materials, tools and equipment

1.2: Analyse Function generator

1.3: Set the working environment

Learning outcome 1.1: Select the materials, tools and equipment

 **Duration: 1hour**

Learning Outcome 1.1 objectives :

By the end of the learning outcome, the trainees will be able to:

1. describe tools, materials and equipment required for repairing function generator

2. classify tools, materials and equipment used for repairing function generator

 **Resources**

Equipment	Tools	Materials
-Function generator -Screwdriver machine -Soldering station Digital -Multimeter -Air blowing machine -PPE -Computer -Projector	-Soldering irons -Screwdrivers -Pliers -Spanners -Allen key -Brushes -Sponge -Soft cloth	-Electronic components -Soldering tin -Screws -Internet - Books and handouts -Markers -Chalks

Advance preparation:

Read the impact of unprotected technician on the electronic site

Research on standards and rules of wearing the PPE on the Jobsite

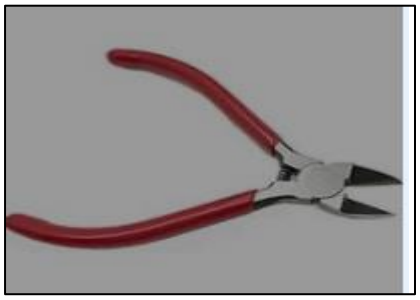
Availability of tools, materials and equipments

Indicative content 1.1: Description of tools, materials and equipment

Tools: A tool is an object used to extend the ability of an individual to modify features of the surrounding environment

Classification of tools and their uses

- **Repairing tools**
  - ✓ **Soldering irons**: A soldering iron is a hand tool used to heat solder, usually from an electrical supply at high temperatures above the melting point of the metal alloy. This allows for the solder to flow between the work pieces needing to be joined
  - ✓ **Screwdrivers:** A screwdriver is a tool, manual or powered, used for screwing (installing) and unscrewing (removing) screws. A typical simple screwdriver has a handle and a shaft, ending in a tip the user puts into the screw head before turning the handle
  - ✓ **Universal Pliers:** Universal Pliers: are a hand tool used to hold objects. it is designed to hold especially hot metal and also is useful for bending and compressing a wide range of materials.
  - ✓ **Cutting pliers:** designed to be used for a combination of tasks including cutting wire
  - ✓ **stripping pliers:** its purpose is to strip the insulation off of the end of wires
  - ✓ **Cable cutters:** The cable cutter is a tool used to cut copper or aluminum electric wire from #1 through 1000MCM. They come in four varieties: palm grip, manual two-handled units, ratchet cutters and electric cutters.



  - ✓ **Crimping tools:** A crimping tool is a device used to conjoin two pieces of metal by deforming one or both of them to hold each other. The result of the tool's work is called a crimp. An example of crimping is affixing a connector to the end of a cable.

- **Cleaning tools**
  - ✓ **Brushes:** Brushes perform a multitude of cleaning tasks. For example, brushes lightly dust the tiniest figurine, they help scrub stains out of clothing and shoes, they remove grime from tires, and they remove the dirt and debris found on floors with the help of a dust pan.
  - ✓ **Sponge:** a piece of a soft, light, porous absorbent substance originally consisting of the fibrous skeleton of an aquatic invertebrate but now usually made of synthetic material, used for washing and cleaning.

  - ✓ **Soft cloth:** Soft cloth is an excellent way to lift organic matter (bird droppings, bugs, pollen, dirt, etc.) and inorganic matter (road film, hard water spots, salt, etc.) off a vehicle's surface. A soft cloth cleans the hard-to-get places (front by license plate, rocker panels and rear of vehicle) most effectively.

Materials: Materials /Consumables are goods that are intended to be consumed. Consumables are in contrast to durable things

Classifications of materials and their use

- **Repairing materials**
  - ✓ **Soldering tin:** Soldering is the use of a conductive substance with a low melting point (solder) to electrically connect components together. It is frequently used to join wires to leads of components such as switches or to join components of all kinds to a printed circuit board.
  - ✓ **Screws:** a short, slender, sharp-pointed metal pin with a raised helical thread running round it and a slotted head, used to join things together by being rotated so that it pierces wood or other material and is held tightly in place.
  - ✓ **Electronic components**: are all electronics component that is used to replace any defected component in devices

Equipment most commonly refers to a set of tools or other objects commonly used to achieve a particular objective. Different jobs require different kinds of equipment.

Equipment and their uses

- ✓ **Function generator:** A signal or function generator is a device that can produce various patterns of voltage at a variety of frequencies and amplitudes. A common use is to test the response of circuits to a known input signal. Most function generators allow you to generate sine, square or triangular AC function signals

- ✓ **Screwdriver machine:** Screwdriver, tool, usually hand-operated, for turning screws with slotted heads. For screws with one straight diametric slot cut across the head, standard screwdrivers with flat blade tips and in a variety of sizes are used

- ✓ **Di-soldering gun machine:** is used to the removal of solder and components from a circuit board for troubleshooting, repair, replacement, and salvage.

- ✓ **Digital Multimeter:** A digital multimeter is a test tool used to measure two or more electrical values—principally voltage (volts), current (amps) and resistance (ohms). It is a standard diagnostic tool for technicians in the electrical/electronic industries.
- ✓ **Air blowing machine:** Blowers serve three main functions: heating, cooling and air flow. Although unit designs range from simple and complex, most blowers usually consist of some type of fan-like apparatus. Some blowers also use pressure pumps to move air or gases. Heating blowers direct warm or hot air into cooler areas.

- ✓ **PPE:** Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.

- ✓ **Rivet gun:**
  A rivet gun, also known as a rivet hammer or a pneumatic hammer, is a type of tool used to drive rivets. The rivet gun is used on rivet's factory head (the head present before riveting takes place), and a bucking bar is used to support the tail of the rivet. ... Nearly all rivet guns are pneumatically powered.

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on different types of personal protective equipment
- ✓ Have students in their respective groups discuss repairing tools and cleaning tools

Practical learning Activity

- ✓ Provide students with pictures of the different equipment, tools and materials used to repair function generator, and ask them to match each item with its respective function.

Points to Remember (Take home message)

Tools: Any physical item that is used to achieve a goal but is not consumed during this process.
Examples: Hammer, Pliers, Screwdriver.

Materials: Are things that are needed to do a particular activity and be consumed during the process.
Examples: Wires, Insulator, Screws

Equipment: is defined as set of tools designed for performing the specific task and many of them consume electric power during the process.
Examples: Multimeter, Blower, Screwdriver machine

Learning outcome 1.1 formative assessment

Written assessment

1. What is the purpose of PPE?
   Answer:

Personal protective equipment, commonly referred to as "PPE", is equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses. These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards.

2. Helmet, gloves, safety shoes are the types of PPE? Answer by true or false.

Answer: True

3. describe the function of Crimping tools
   Answer: Crimping tools: A crimping tool is a device used to conjoin two pieces of metal by deforming one or both of them to hold each other. The result of the tool's work is called a crimp. An example of crimping is affixing a connector to the end of a cable.

Practical assessment

Create a physical matching activity where students physically match the Identification of Tools, materials and equipment with their respective Classification.

Checklist	Score	
	Yes	No
Indicator: Tools are well classified		
✓ Repairing tools		
✓ Cleaning tools		
Indicator: Materials are well classified		
✓ Adhesives		
✓ Repairing materials		
Indicator: Equipment are well identified		
✓ Screwdriver machine		
✓ Function generator		
✓ Soldering station		
✓ Digital Multimeter		
✓ Air blowing machine		
Observation		

Learning outcome 1.2: Analyze Function generator

 **Duration: 3 hours**

Learning outcome 1.2 objectives:

By the end of the learning outcome, the trainees will be able to:

1.To Describe function of generator
2. To Identify different types of function generator
3. To Describe of main parts of Function generator
4. Identification of technical specifications

 **Resources**

Equipment	Tools	Materials
-Function generator -Flip chart -Computer -Projector	-Eraser -Board	- picture - video -Internet - Books and handouts -Markers

 **Advance preparation:**

-Research on need of function generator repair needs

- Availability of electricity

-Availability of tools, materials and equipment

Indicative content 1.2: Description of function generator

A function generator is a signal source that has the capability of producing different types of waveforms as its output signal.

The most common output waveforms are:

- sine-waves,
- triangular waves,
- square waves, and
- sawtooth waves.

The frequencies of such waveforms may be adjusted from a fraction of a hertz to several hundred kHz.

Frequency range and waveforms

- Hz to 2000 MHz Sine wave
- Hz to 160 MHz Square wave
- Hz to 800 kHz Triangle wave

Actually, the function generators are very versatile instruments as they are capable of producing a wide variety of waveforms and frequencies. In fact, each of the waveforms they generate is particularly suitable for a different group of applications.

The uses of sinusoidal outputs and square-wave outputs have already been described in the earlier Arts. The triangular-wave and sawtooth wave outputs of function generators are commonly used for those applications which need a signal that increases (or reduces) at a specific linear rate. They are also used in driving sweep oscillators in oscilloscopes and the X-axis of X-Y recorders.

Many function generators are also capable of generating two different waveforms simultaneously (from different output terminals, of course). This can be a useful feature when two generated signals are required for a particular application.

For instance, by providing a square wave for linearity measurements in an audio-system, a simultaneous sawtooth output may be used to drive the horizontal deflection amplifier of an oscilloscope, providing a visual display of the measurement result.

For another example, a triangular-wave and a sine-wave of equal frequencies can be produced simultaneously. If the *zero crossings* of both the waves are made to occur at the same time, a linearly varying waveform is available which can be started at the point of zero phase of a sine-wave.

Another important feature of some function generators is their capability of phase-locking to an external signal source. One function generator may be used to phase lock a second function generator, and the two output signals can be displaced in phase by an adjustable amount.

In addition, one function generator may be phase locked to a harmonic of the sine-wave of another function generator.

By adjustment of the phase and the amplitude of the harmonics, almost any waveform may be produced by the summation of the fundamental frequency generated by one function generator and the harmonic generated by the other function generator. The function generator can also be phase locked to an accurate frequency standard, and all its output waveforms will have the same frequency, stability, and accuracy as the standard.

Where are function generators used?

- Integrated electronic testing
- Embedded systems
- Digital circuits
- Analogue signal processing
- Laboratory testing

Controlling Aspects of Function Generator

Apart from providing the selection of fundamental waves, a function generator can even provide multiple controlling options and those are discussed below:

DC offset value – This helps in varying the signal voltage corresponding to ground level.

Frequency – The frequency control in the function generator varies the basic frequency level where the wave repeats, and this is not dependent on the type of waveform.

Duty cycle – This controlling option alters the high and low voltage ratio timings in the sine wave which means altering the square wave having a 1:1 duty cycle to another type of waveforms such as triangles having the same level of rising and fall timings.

Selection of waveform – This controlling option allows to a selection of various types of fundamental waveforms which are sine, triangular and square waveforms.

Triggering input – This is the input terminal used for counting the frequency

Adjustment knob – This control sets the parameter chosen by other buttons in the device

Adjustment for amplitude-offset – This is the knob that helps in adjusting either the DC offset voltage or amplitude level of the signal.

Specifications

This section explains the technical specifications for a general type of function generator.

Parameter	**Value**
Output amplitude	Generates peak to peak voltage of 10 volts
DC offset voltage	Generates an adjustable voltage of -5 volts to +5 volts
Output impedance	50 Ohms
Frequency stability	0.1%/hour for the analog type of function generators 500 ppm for the digital type of function generators
Maximum distortion for sine waveform	1% for analog type devices, For arbitrary wave generators, it is < -55dB below 50kHz and -40dB above 50 kHz
Supported modulation types	Amplitude, Phase, and frequency modulations are supported
Frequency range	Multiple levels of frequencies are generated

Types of function generator

As the progress of technology moving forward, there are various types of function generator which suits even for the current digital technology and the types are as follows:

Rack-based type – This is like a component present inside the rack system such as PXI. This main usage of this type of function generator is testing the applications and it has a slot that is used either for controlling or linking to the computer. Cards used for testing the instrument are placed into the slot thus making the test system to be ready for testing any specific application.

The testing cards can be of any kind of testing devices like oscilloscope, voltmeter, ammeter, and others.

Computer-based type – This is a distinct process where it uses a software-dependent computer to offer the necessary waveform types and then employs digital cards of the computer audio for the wave.

Even this approach is not expensive, it may not hold the ability for delivering high accuracy when compared with other types of function generators.

And if there is any damage in the output because of misconnections or testing results, this leads to high expensive repairs.

USB type – Many various small types of function generators can be used as USB type of function generators. This device has a core section of the function generator inside the section which connects the computer through a USB device. This procedure explains that the power and controlling interfaces can utilize computers other than costly ones and the space necessary to offer these inside a huge box for testing the device.

Benchtop type – This is the extensively used type of function generator. The testing components are present in the box which is placed in the lab workbench. The testing equipment is controls, power supply, a connector to connect the output and display.

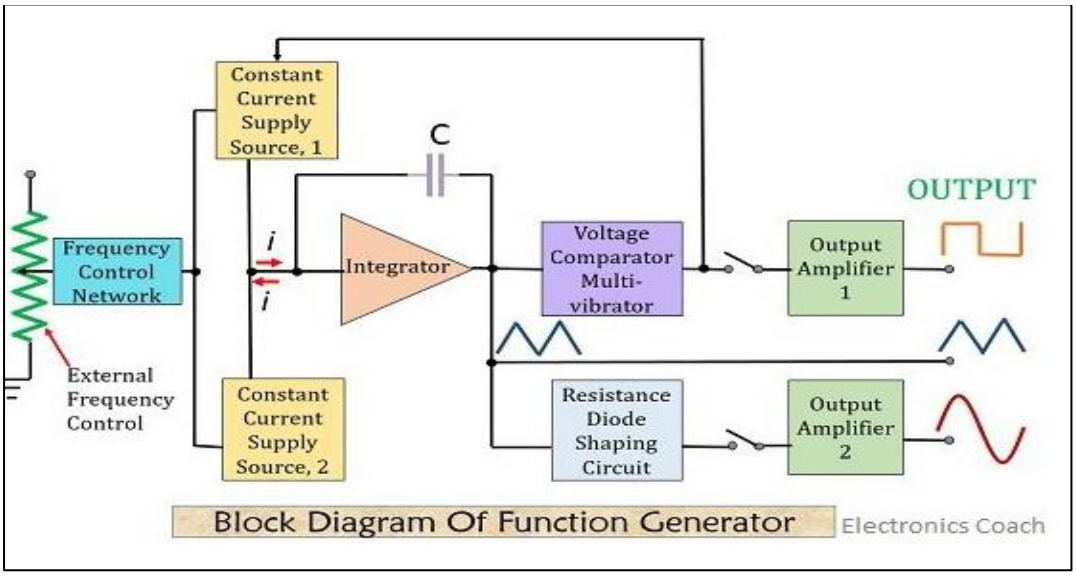
Applications of Function Generator

There are extensive uses of a function generator across multiple domains and those are:

- In semiconductor domain
- Used for testing DC power supply
- For testing the delay margin
- Analyse the audio DAC
- To test clock frequency functional range of digital circuits
- In medical domain
- Used for testing medical ultrasound devices, pacemakers, implantable medical equipment, and other detector circuits
- In radiofrequency domain
- Function generators are used for calculating the BPF frequency response
- Used in EMC radio observations
- Utilized in operational testing of RFID receiver integrated circuits
- Measures pulsed noise figures
- In automotive domain
- Employed for testing and optimization of engine controlling units
- Analyse switching signals of IGBT circuitry

In addition to these, function generators are also extensively used in industrial applications, research, and many others.

FUNCTION GENERATOR BLOCK DIAGRAM AND IT'S WORKING



A frequency control network used here whose frequency is controlled by the variation in the magnitude of current. The current source 1 and 2 drives the integrator.

By using Function Generator, we can have a wide variety of waveforms whose frequency changes from 0.01 Hz to 100 KHz. The two current sources are regulated by the frequency-controlled voltage.

A constant current is supplied to the integrator by current supply source 1. Due to this, the voltage of the integrator rises linearly with respect to time. This linear rise is according to the output signal voltage equation:

. $$V_{out} = \frac{-1}{C} \int_0^t i \, dt$$

Any increase or decrease in the current will resultantly increase or decrease the slope of the voltage at the output and thus controls the frequency

The **Voltage Comparator Multi-vibrator present here cause variation in the state** of the integrator output voltage at a previously determined maximum level. Due to this change of state, the current supply from source 1 cut-off and switches to supply source 2.

A reverse current is supplied to the integrator by current source 2. This reverse current cause drops in the output of integrator linearly with time. As before this time also, when the output attains a predetermined level, the comparator again changes its state and switches to current supply source 1.

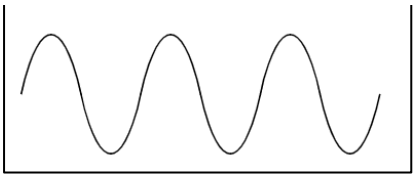
Thus, we will have a triangular wave at the output of the integrator whose frequency depends on current by the supply sources as we can see in the block diagram shown above. A square wave signal is obtained at the output of the comparator.

The **resistance diode network** employed in the circuit **changes the slope of that triangular wave** with distortion less than 1%. The output amplifier thus helps to provide two waves at the output simultaneously. This captured signal can be displayed by using an oscilloscope.

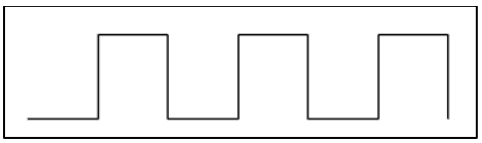
Function generator capabilities

Function generators are capable of producing a variety of repetitive waveforms, generally from the list below:

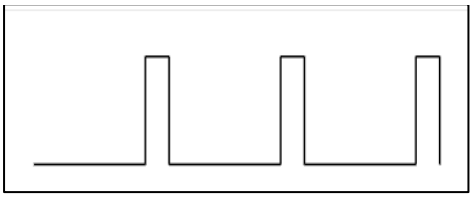
Sine wave: A function generator will normally be able to act as a sine wave generator. This is the standard waveform that oscillates between two levels with a standard sinusoidal shape. Using the function generator as a sine wave generator is one of the more commonly used applications. Sine waves are widely used in testing applications.



Square wave: Another very widely used waveform is the square wave. It consists of a signal moving directly between high and low levels. Used as a square wave generator, this test instrument provides a very useful source of a basic digital waveform.



pulse: A pulse waveform is another type that can be produced by a function generator. It is effectively the same as a square wave, but with the mark space ratio very different to 1:1. This form of waveform is again often used within digital applications.



Triangular wave: This form of signal produced by the function generator linearly moves between a high and low point. This form of waveform is often generated using an operational amplifier acting as an integrator.

The triangular waveform generator typically also has a square wave output as well, and it is used as the basis for generating all the waveforms in a function generator test instrument.
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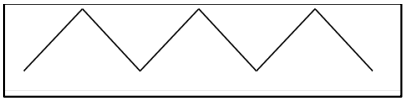
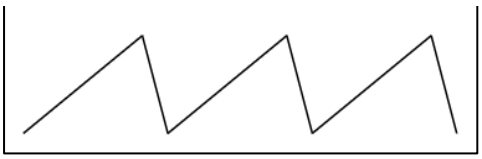
The triangular waveform is often used in testing amplifiers - it is far easier to see distortion and clipping on a triangular waveform than it is on a sine waveform.



Sawtooth wave: Again, this is a triangular waveform, but with the rise edge of the waveform faster or slower than the fall, making a form of shape similar to a sawtooth. It is generated by the same circuit as the triangular waveform, but with the different rise and fall times created by changing the charge rate for the rise and fall elements of the integrator.



Function generator controls

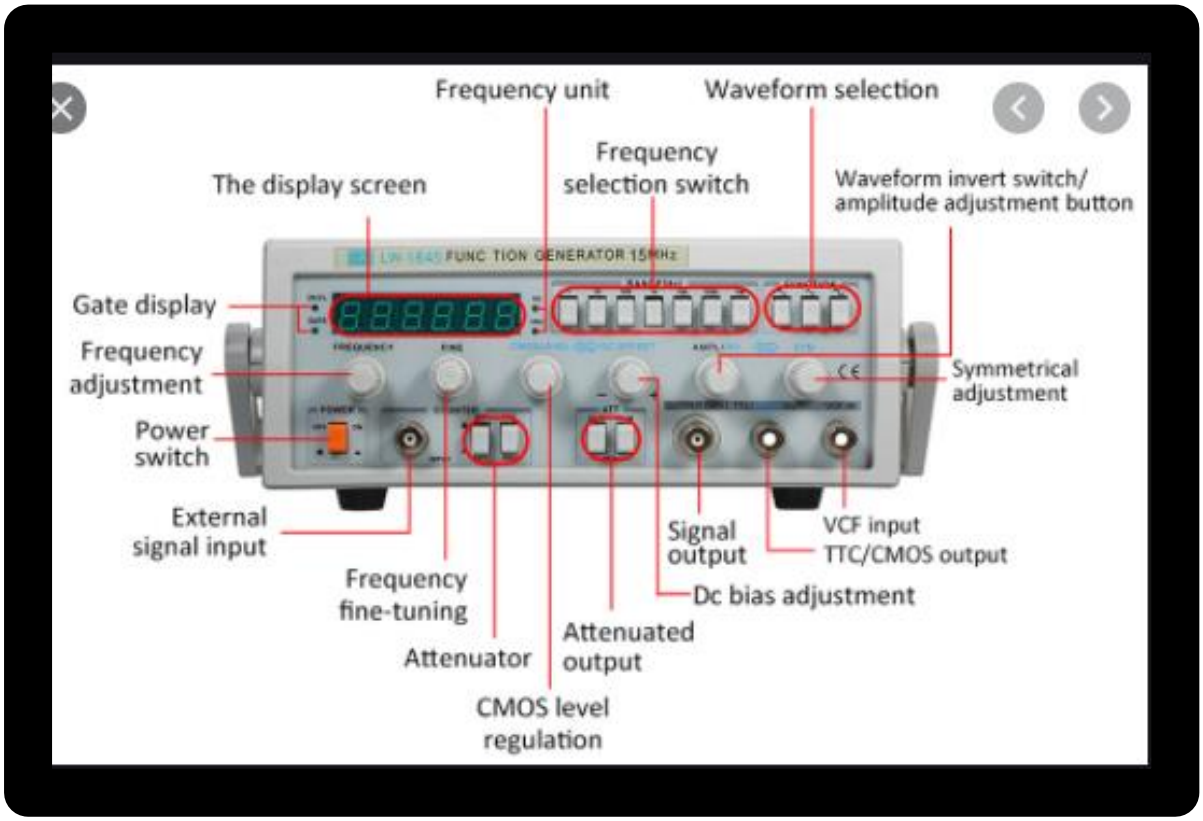
In addition to a selection of the basic waveforms that are available, other controls on the function generator may include:

Frequency: As would be expected, this control alters the basic frequency at which the waveform repeats. It is independent of the waveform type.

Function generator usage

Function generators are normally used within electronics development, manufacturing test and service departments. They provide a flexible form of waveform generation that can be used in many tests. A signal or function generator is a device that can produce various patterns of voltage at a variety of frequencies and amplitudes. A common use is to test the response of circuits to a known input signal. Most function generators allow you to generate sine, square or triangular AC function signals.

EXTERNAL PARTS OF FUNCTION GENERATOR



- **The main internal parts of Function generator:**
  - ✓ **Power system:** An electric power system is a network of electrical components deployed to supply, transfer, and use electric power. An example of a power system is the electrical grid that provides power to homes and industries within an extended area.
  - ✓ **Control part**: are the parts of function generator (especially software parts) that control others parts (hardware parts)
  - ✓ **Displayer**: Is a setting or presentation of something in open view
- **Identification of different Types of function generator:**

✓ **Analog function generator:** Analog signal generators based on a sine-wave oscillator were common before the inception of digital electronics, and are still used. There was a sharp distinction in purpose and design of radio frequency and audio frequency signal generators.

✓ **Digital function generator:** A logic signal generator or data pattern generator or digital pattern generator produces logic signals - that is logical 1s and 0s in the form of conventional voltage levels. It is different from a "pulse/pattern generator",

which refers to signal generators able to generate logic pulses with different analog characteristics (such as pulse rise/fall time, high level length, ...).

- ✓ **Sweep function generator:** A sweep generator is a piece of electronic test equipment similar to, and sometimes included on, a function generator, which creates an electrical waveform with a linearly varying frequency and a constant amplitude. Sweep generators are commonly used to test the frequency response of electronic filter circuits.

- **Identification of technical specifications**

Before starting function, generator repair the following specification should be identified to carry activities as well:

- ✓ **Voltage rating**: The voltage rating of a cable is the highest voltage that may be continuously applied to a completed cable construction in compliance with the relevant cable standard or specification (refer to this link if you are not sure what the definition of a volt is).
- ✓ **Current rating:** The higher the output current rating, the more power will be able to be supplied. Current rating is the maximum current that a fuse will carry for an indefinite period without too much deterioration of the fuse element.
- ✓ **Ripple and noise:** Ripple is the inherent ac component of the output voltage caused by the internal switching of the power supply. Noise is the manifestation of parasitic within the power supply that appear as high frequency voltage spikes on the output voltage
- ✓ **Temperature:** the degree or intensity of heat present in a substance or object, especially as expressed according to a comparative scale and shown by a thermometer or perceived by touch.
- ✓ **Maximum frequency:** The maximum clock frequency at which a digital circuit can operate is called its f_{MAX}. The f_{MAX} is the maximum rate at which the outputs of registers are updated. The physical propagation delay of the signal across Boolean logic between two consecutive register stages limits the clock speed.
- ✓ **Waveform types:** Within electrical and electronic circuits, there are many different types of waveform and signal that can be seen: sine waves, square waves, triangular, sawtooth, ramp and the like.

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on different types of function generator
- ✓ Have students in their respective groups discussing about internal and external parts of function generator.

Practical learning Activity

- ✓ Provide students with block diagram of the function generator and ask them to describe its working principle

Points to Remember (Take home message) (Take home message)

A function generator is a signal source that has the capability of producing different types of waveforms as its output signal.
The most common output waveforms are:

- ✓ sine-waves,
- ✓ triangular waves,
- ✓ square waves, and
- ✓ Sawtooth waves.

- **Learning outcome 1.2 formative assessment**

Written assessment

1. Outline the most common output waveforms
   Answer:

- sine-waves,
- triangular waves,
- square waves, and
- Sawtooth waves.

2. The following are main internal parts of function generator except one. Tick it.
   a) Displayer
   b) Cable
   c) Control part
   d) Power system

Answer: b. Cable

Practical assessment

Analyse, Identify and describe the main Types and parts of Function Generator to the Technical Specification.

Checklist	Score	
	Yes	No
Indicator: Types of function generator are well identified		
✓ Analog function generator		
✓ Digital function generator		
✓ Sweep function generator		
Indicator: Main parts of Function generator are well described		
✓ Power system		
✓ Control part		
✓ Displayer		
Indicator: Technical specifications of Function generator are well identified		
✓ Voltage rating		
✓ Current rating		
✓ Output signal		
✓ Ripple and noise		
✓ Temperature		
✓ Maximum frequency		
✓ Wave form types		

Learning Outcome1.3: Set the working environment

 **Duration: 1hour**

Learning outcome 1.3 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Describe cleaning techniques
2. Apply safety rules and regulations
3. Describe arrangement techniques of tools, materials and equipment

 **Resources**

Equipment	Tools	Materials
Function generator Soldering irons Screwdriver machine Soldering station Digital multimeter	Screwdrivers Pliers Spanners Brushes Sponge Soft cloth Allen key	Soldering tin Screws Electronic components Adhesives

 **Advance preparation:**

-Research on need tools, materials and equipment used to repair function generator.

- Availability of tools , materials and equipment

Indicative content 1.3: Arranging and cleaning techniques

- **Cleaning techniques and Tools/equipment and materials used in cleaning**

Cleaning is the process of removing the unwanted substances, such as dirt, infection agent from equipment, tools or working environment.

We have three main techniques used in cleaning which are the following:

✓ **Blowing cleaning**

Is the way to clean or remove dirty using air speed, Equipment used: Vacuum cleaner, air blower.

✓ **Towering cleaning**

Is a cleaning process of environment/tools/equipment using chemical solution other than water.

✓ **Brushing cleaning:**

Is the cleaning technique that is used to remove dirt at work place using brushes.

Apply safety rules and guidelines

For any repair task apply, someone should apply the following safety rules and guidelines:

- **Apply safety rules and guidelines**

✓ **Individual safety Precautions:** a safety precaution that is taken in order to ensure that you are safe and not dangerous. safety precautions visible everywhere:

- Overall,
- Helmet,
- Goggles,
- Small boat,
- Inflatable rubber boats..

✓ **Electrical safety precautions**: It's vitally important to take safety precautions when working with electricity.

Safety must not be compromised and some ground rules need to be followed first are the following:

- Avoid water at all times when working with electricity.
- Never touch or try repairing any electrical equipment or circuits with wet hands. It increases the conductivity of the electric current.
- Always use insulated tools while working.
- If you are working on any receptacle at your home then always turn off the mains.
- Always use appropriate insulated rubber gloves and goggles while working on any branch circuit or any other electrical circuit.
- Never try repairing energized equipment. Always check that it is de-energized first by using a tester

✓ **Operating safety precautions:** includes the following:

- Your **safety** is your personal responsibility.
- Always follow the correct procedures.
- Never take shortcuts.
- Clean and organize your workspace.

- **Techniques of arranging tools, materials and equipment**

✓ Arrangement by types
✓ Arrangement by uses
✓ Arrangement by size
✓ Arrange by nature
✓ Arrangement of manufacturer instructions

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on different techniques used to clean working area.
- ✓ Have students in their respective groups discussing about arrangement techniques used to arrange tools, materials and equipment used to repair function generator.

Practical learning Activity

- ✓ Provide students all tools, materials used to clean workplace, ask them to identify them according to their types.

Points to Remember (Take home message)

Cleaning is the process of removing the unwanted substances, such as dirt, infection agent from equipment, tools or working environment.
We have three main techniques used in cleaning which are the following:

1. **Blowing**

Is the way to clean or remove dirty using air speed.
Equipment used: Vacuum cleaner, air blower.

2. **Towering**

Is a cleaning process of environment/tools/equipment using chemical solution other than water.

3. **Brushing**

Is the cleaning technique that is used to remove dirt at work place using brushes.

Learning outcome 1.3 formative assessment

Written assessment

Q1. List cleaning techniques

Answer:

- ✓ Blowing
- ✓ Toweling
- ✓ Brushing

Q2. Those are arrangement techniques except one. Select all the correct

a) Arrangement by size
b) Arrangement by nature
c) Arrangement by type
d) Arrangement by uses
e) Arrangement by manufacture instruction
f) Arrangement by user

Answer:

a) Arrangement by types
b) Arrangement by uses
c) Arrangement by size
d) Arrange by nature
e) Arrangement of manufacturer instructions

Practical assessment

Function Generator Of **ABC Company LTD** have got faulty component internally Which course not working well, as electronics repair Technician you are hired Test it for well know if it operation is possible after finishing all required Task you are recommended to Identify Arranging and Cleaning Techniques .

Checklist	Score	
	Yes	No
Indicator: Cleaning Techniques are well identified		
✓ Blowing		
✓ Brushing		
✓ Toweling		
Indicator: safety rules and guidelines are well identified		
✓ Individual safety precautions		
✓ Electrical safety precautions		
✓ Operating safety precautions		
• Indicator: Techniques of arranging tools, materials and equipment are well identified		
✓ Arrangement by types		
✓ Arrangement by uses		
✓ Arrangement by size		
Observation		

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LEARNING UNIT 2 : RECTIFY FUNCTION GENERATOR

STRUCTURE OF LEARNING UNIT II

Learning outcomes:

2.1. Check Function generator defective parts

2.2. Fix Power supply faulty components

2.3. Test the Function Generator

Learning Outcome 2.1. Check Function generator defective parts

 **Duration: 10hours**

Learning Outcome 2.1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. Disassemble function generator
2. Identify Function generator common faults
3. Describe checking methods

 **Resources**

Equipment	Tools	Materials
Function generator Soldering irons Screwdrivers Screwdriver machine Soldering station Digital multimeter Air blowing machine Rivet gun PPE Computer Projector	Pliers Spanners Brushes Sponge Soft cloth Allen key	Markers Chalks Internet Books and handouts Electronic components Soldering tin Screws Adhesives

 **Advance preparation:**

-Read deeply function generator faults

-Availability of tools, materials and equipment

-Availability of electricity

Indicative content 2.1: Description of function generator faults

- **Function generator disassembling process**

- Turn off the power and disconnect the power cable
- Interpretation of the user manual
- Remove the cover
- Disconnect the internal functional parts

- **Identification of Function generator common faults**

General faults that occur in function generator are the following:

✓ **Transformer fault**: A number of transformer fault conditions can arise practically in any time following some special situations.

These include the following five most common internal faults and few external:

- Earth faults,
- Core faults,
- Interturn faults,
- Tank faults, and
- External factors.

✓ **Rectifier fault**: Rectifier is the weaknesses of the power generation system. Potential faults of the DFBLSG can be divided into short circuit and open circuit. Because the short-circuit faults are very harmful to the system, it should be protected by a fuse.

✓ **Smoothing circuit fault:** electrical engineering a circuit used to remove ripple from the output of a direct current power supply.

✓ **Regulation fault;** if you still experience a Regulation Error fault there is a good chance something has broken or damaged inside the power supply preventing it from making full voltage/current/power.

✓ **Ventilation fault:** There are various problems that can occur during mechanical ventilation, including the following:

- Respiratory distress.
- Ventilator alarms.
- System leaks.
- Circuit disconnection.
- Inadequate oxygenation.
- Patient-ventilator asynchrony.
- Artificial airway problems.

N.B: All above faults may be **caused** by:

- ✓ Over voltage, and
- ✓ Going beyond of operating temperature of electronics components.

- **Checking methods**

Checking methods: are all the methods someone may use to determine the faults in function generator. Among them used are shown below:

- ✓ **Visual**: Visual inspection is a technique for detecting defects using the naked eye to ensure equipment is working properly or that manufactured products are being made to specification. This can include visual inspections done in person or remotely using digital images. The evolution of visual inspection.

- ✓ **Measuring**: The precise detection, alignment and monitoring of industrial components, machines and systems place the highest demands on surveying. This work requires measuring methods adapted to the respective task and suitable measuring instruments with which the required accuracies can be achieved.

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on general faults can could occur on function generator
- ✓ Have students in their respective groups discussing about the possible causes of faults occurred on function generator.

Practical learning Activity

- ✓ Provide students all general faults that could occur on function generator, ask them to identify them.

Points to Remember (Take home message) (Take home message)

Identification of Function generator common faults

General faults that occur in function generator are the following:

- ✓ Transformer fault
- ✓ Rectifier fault
- ✓ Smoothing circuit fault
- ✓ Regulation fault
- ✓ Ventilation fault

N.B: All above faults may be caused by:

- ✓ Over voltage, and
- ✓ Going beyond of operating temperature of electronics components.

Learning outcome 2.1 formative assessment

Written assessment

Q1. What are steps followed to disassemble function generator

Answer:

- Turn off the power and disconnect the power cable
- Interpretation of the user manual
- Remove the cover
- Disconnect the internal functional parts

Q2. Outline general faults that could occur on function generator

Answer:

- ✓ Transformer fault
- ✓ Rectifier fault
- ✓ Smoothing circuit fault
- ✓ Regulation fault
- ✓ Ventilation fault

Q3. After defining “checking method”, give the methods used to check fault on function generator.

Answer:

Checking methods: are all the methods someone may use to determine the faults in function generator.

We have two types of checking function generator faults.

- Visual
- Measuring

Practical assessment

Function Generator Of **ABC Company LTD** have got faulty component internally Which course not working well, as electronics repair Technician you are hired to Identify the common faults of the device. **Note** that checking methods must be regulated.

.

Checklist	Score	
	Yes	No
Indicator: Function generator common faults are well identified		
✓ Transformer fault		
✓ Rectifier fault		
✓ Smoothing circuit fault		
✓ Regulation fault		
✓ Ventilation fault		
• Indicator: Checking methods are well identified		
✓ Visual methods		
✓ Measuring methods		
Observation		

Learning outcome 2.2 : Fix function generator components

 **Duration: 15hours**

Learning outcome 2.2 objectives :

By the end of the learning outcome, the trainees will be able to:

1. Fix function generator faults

2. Assemble function generator

 **Resources**

Equipment	Tools	Materials
Function generator Soldering irons Screwdrivers Screwdriver machine Soldering station Digital multimeter Air blowing machine Rivet gun PPE Computer Projector	Pliers Spanners Brushes Sponge Soft cloth Allen key	Markers Chalks Internet Books and handouts Electronic components Soldering tin Screws Adhesives

 **Advance preparation:**

. Availability of tools, materials and equipment used to repair function generator

. Availability of electricity

Indicative content 2.2: Fixing function generator faults techniques

- **Power supply problems can affect:**
  - The performance,
  - Stability, and
  - Functionality of devices that rely on electricity.
  - ✓ **They can be caused by various sources, such** as:
    - Distribution network faults,
    - System switching,
    - Weather and environmental conditions,
    - Heavy plant and equipment, or
    - Faulty hardware.
    - They can also result from overloaded, dirty, or
    - Unstable power supplies,
    - Loose connections,
    - Inadequate wattage, or
    - Reversed polarity.
    -
- **Some symptoms of power supply problems include**
    - No power light,
    - No fan movement,
    - No device operation,
    - Audible noise,
    - Jittering,
    - Oscillations, and
    - Failures**.**

  ✓ **Power supply problems can be avoided, protected against, or mitigated by:**
    - Careful consideration of design specifications,
    - Additional calculations, and
    - Reliable power products and tools

- Fixing function generator faults techniques

✓ Disordering and soldering faulty part
✓ Replace faulty components by their corresponding.
✓ Remove short/open circuit

Disordering is the process of removing solder from a connection to allow for component changes or repairs.

Soldering is the process of creating a permanent electrical connection between two or more components by melting and flowing solder to make the joint.

Open circuit: When there is a break in the conducting path of an electric circuit.

Short circuit: When there is an unwanted path of very low resistance in an electric circuit.

The following conditions can exist in any given circuit:
Open – no current can flow.
Closed – current is flowing.

- **Assembling the function generator process.**

✓ Interpretation of the user manual
✓ Connect the internal functional parts
✓ Attach the cover
✓ Turn ON the power and connect the power cable

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on different techniques used to fix faults on function generator.
- ✓ Have students in their respective groups discussing about causes of power supply faults.

Practical learning Activity

- ✓ Provide students all tools, materials used to repair function generator, ask them to disassemble and assemble function generator.

Points to Remember (Take home message) (Take home message)

Fixing function generator faults techniques

- ✓ Disordering and soldering faulty part
- ✓ Replace faulty components by their corresponding.
- ✓ Remove short/open circuit

Assembling the function generator process.

- ✓ Interpretation of the user manual
- ✓ Connect the internal functional parts
- ✓ Attach the cover
- ✓ Turn ON the power and connect the power cable

Learning outcome 2.3 formative assessment

Written assessment

Q1. What are symptoms of power supply problems?

Answer:

- No power light,
- No fan movement,
- No device operation,
- Audible noise,
- Jittering,
- Oscillations, and
- Failures**.**

Q2. Identify the techniques of fixing function generator faults

Answer:

- ✓ Disordering and soldering faulty part
- ✓ Replace faulty components by their corresponding.
- ✓ Remove short/open circuit

Q3. Answer by true or false

a) Soldering is the process of creating a permanent electrical connection between two or more components by melting and flowing solder to make the joint.
b) Short circuitt is a break in the conducting path of an electric circuit.

Answer:

a) True
b) False

Practical assessment

Function Generator Of **ABC Company LTD** have got faulty component internally Which course not working well, as electronics repair Technician you are hired to fix faulty component for well operation. **Note** that fixing techniques, Disassembling, and assembling process must be regulated.

Checklist	Score	
	Yes	No
Indicator: Fixing function generator faults techniques are well identified		
✓ Disoldering and Soldering faulty part		
✓ Replace faulty components		
✓ Remove short/open circuit		
Indicator: Function generator Disassembling process is well applied		
✓ Interpretation of the user manual		
✓ Turn off the power and disconnect the power cable		
✓ Remove the cover		
✓ Disconnect the internal functional parts		
Observation		

Learning outcome 2.3 Test the function generator

Duration: 5hours

Learning outcome 2.3 objectives :

By the end of the learning outcome, the trainees will be able to:

- Identify testing techniques

Resources

Equipment	Tools	Materials
Function generator Screwdrivers Digital multimeter PPE Computer Projector		Screws Electronic components Internet Books and handouts Markers Chalks

Advance preparation:

. Deeply understanding of testing techniques of function generator

. Availability of tools, materials and equipment used to test function generator

Indicative content 2.3: Testing techniques

- After repairing function generator, applying the following Testing techniques:

✓ **Continuity testing:** A continuity test is an important test in determining the damaged components or broken conductors in a circuit. It can also help in determining if the soldering is good, if the resistance is too high for flow of current or if the electrical wire is broken between two points

There are mainly two methods for checking the continuity of a circuit using a multimeter.

- The first method is to use the continuity mode in the multimeter, which is specially made for this purpose.
- The second method is to use the Ohmmeter.

✓ **Voltage measurement:** Voltage is the difference of electrical potential between two points of an electrical or electronic circuit, expressed in volts.

It measures the potential energy of an electric field to cause an electric current in an electrical conductor. Voltages are usually measured by placing the measuring device in parallel with the component or circuit (load) to be measured.

The measuring device should have an infinite input impedance (resistance) so that it will absorb no energy from the circuit under test and, therefore, measure the true voltage.

✓ **Current measurement:** An ampere (AM-pir), or amp, is the international unit used for measuring current. It expresses the quantity of electrons (sometimes called "electrical charge") flowing past a point in a circuit over a given time.

An **ammeter** (from ampere meter) is a measuring instrument used to measure the current in a circuit.

The most common way to measure current in a circuit is to break the circuit open and insert an ammeter in series (in-line) with the circuit so that all electrons flowing through the circuit must also go through the meter.

✓ **Electronic components testing:** Electronic components testing is a process to know if the components are working fine or not in the circuit or off the circuit. The steps of the testing process vary from component to component.

✓ **Functionality of function generator:** Functional testing is a type of testing that seeks to establish whether each application feature works as per the software requirements. Each function is compared to the corresponding requirement to ascertain whether its output is consistent with the end user's expectations.

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on different techniques used to test function generator.

Practical learning Activity

- ✓ Provide students all equipment used to repair function generator, ask them to test function generator.

Points to Remember (Take home message)

After repairing function generator, applying the following Testing techniques:

- ✓ Continuity testing
- ✓ Voltage measurement
- ✓ Current measurement
- ✓ Electronic components testing
- ✓ Functionality of function generator

Learning outcome 2.3 formative assessment

Written assessment

Q1. Give the testing techniques used to test function generator

Answer:

- Continuity testing
- Voltage measurement
- Current measurement
- Electronic components testing
- Functionality of function generator

Q2. What does it mean by functionality testing?

Answer:

Functional testing is a type of testing that seeks to establish whether each application feature works as per the software requirements. Each function is compared to the corresponding requirement to ascertain whether its output is consistent with the end user's expectations.

Practical assessment

Function Generator Of **ABC Company LTD** have got faulty component internally Which course not working well, as electronics repair Technician you are hired Test it for well know if it operation is possible. **Note** that testing techniques, Disassembling, and assembling process must be regulated.

Checklist	Score	
	Yes	No
Indicator: Function generator testing techniquesare well identified		
✓ Continuity testing		
✓ Voltage measurement		
✓ Current measurement		
✓ Electronic components testing		
✓ Functionality of function generator		

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LEARNING UNIT 3 : DOCUMENT THE WORK DONE

YOUR
LETTERHEAD
HERE

MAINTENANCE REQUEST & WORK ORDER

UNIT: DATE:

WORK REQUESTED (JOB DESCRIPTION):

CHARGE TO: (CIRCLE ONE) TENANT OWNER MANAGEMENT

ASSIGNED TO:

WORK COMPLETED:

DATE COMPLETED:

APPROVED BY:

IF INCOMPLETE, EXPLAIN:

STRUCTURE OF LEARNING UNIT III

Learning outcomes:
3.1. Review the previous work
3.2. Record the work process
3.3. Write technical recommendation

Learning outcomes 3.1: Document the work done

 **Duration: 3hours**

Learning outcome 3.1 objectives:

By the end of the learning outcome, the trainees will be able to:

1. To Describe work document elements
2.To Analyze the previous work document

 **Resources**

Equipment	**Tools**	**Materials**
Flipchart Computer Projector	Board	Markers Chalks Internet Books and handouts Pen

 **Advance preparation:**

Deeply research on the previous work done during repairing function generator

Indicative content 3.1: Description of work done and analysis of previous work

- **Description of work document elements**

✓ **Repairing date**

This is the date provided on the report about work carry out. This date will be used to identify how a device experience fault either according to long-life or fault caused by operator have lack of skills on the device.

✓ **Addresses of technician**

Location where the technician company carry out their daily activity. When you have a device experienced with fault you can visit the technician in that location and ask help to fix the problem of your devices. This address of technician includes: house number, road address, telephone number, company name, email address etc….

✓ **Status of device**

After receiving the device, you have to check every part of that device to identify the part experienced problem. Then write the behaviours of that device for further maintenance.

✓ **Name of the repaired parts**

After repairing the device show its part had problem in order to increase the measurement on recommendation councils and how they can take care on that part of that device.

✓ **Work carried out**

Show how you fix the problem, show also the techniques used to identify the problem and fix it. Provide also tools, equipment and materials used to fix that problem of a device.

✓ **Recommendation**

Give advice according to work carry out and fault identified, for future faults prevention. Simple deal with the rules and regulation you can take in order to avoid many faults for our devices.

- **Analysis of the previous work document**

✓ **Previous faults**

Before starting repairing activities, first review the previous report to identify the faults of those devices. The repair according to the previous report if there is no relation with the previous faults. And help the technicians to identify faults easier.

✓ **Previous used Techniques**

Review the previous techniques used to fix the problem. If it can be possible to reuse you can go ahead. Else, apply another technique to fix the present faults.

✓ **Previous status of function generator**

Review the status of the device before it experienced with a problem, and determine how a device being affected or crushed.

✓ **Previous recommendation**

Review the previous recommendation to identify if the advice they had given were respected else, they have to replace some part for better performance.

 **Theoretical learning Activity**

- ✓ Conduct brainstorming session with the student on the elements of work document.

 **Practical learning Activity**

- ✓ Provide students all necessary items used to make work document, ask them to document the work done.

Points to Remember (Take home message)

The elements of work done are:

- ✓ Repairing date
- ✓ Addresses of technician
- ✓ Status of Function generator parts
- ✓ Name of the repaired parts
- ✓ Work carried out
- ✓ Recommendation

Previous work document consists of:

- ✓ Previous faults
- ✓ Previous used Techniques
- ✓ Previous status of the Function generator
- ✓ Previous recommendation

Learning outcome 3.1 formative assessment

Written assessment

Q1. Outline the elements of work done after repairing function generator

Answer:

- Repairing date
- Addresses of technician
- Status of Function generator parts
- Name of the repaired parts
- Work carried out
- Recommendation

Q2. Recommendation is to Give advice according to work carry out and fault identified, for future faults prevention. Simple deal with the rules and regulation you can take in order to avoid many faults for our devices. (Answer by **true** or **false**)

Answer:

True

Q3. Identify the previous work carried out in repairing function generator.

Answer:

- Previous faults
- Previous used Techniques
- Previous status of the Function generator
- Previous recommendation

Practical assessment

Function Generator Of **ABC Company LTD** have got faulty component internally Which course not working well, as electronics repair Technician you are hired Test it for well know if it operation is possible after finishing all required Task you are recommended to **Review the previous work document**. **Note** that testing techniques, Disassembling, and assembling process must be regulated.

Checklist	Score	
	Yes	No
• Indicator:work document elements are well described		
✓ Repairing date		
✓ Addresses of technician		
✓ Status of Function generator parts		
✓ Name of the repaired parts		
✓ Work carried out		
✓ Recommendation		
• Indicator:previous work document is well interpreted		
✓ Previous faults		
✓ Previous used Techniques		
✓ Previous status of the Function generator parts		
✓ Previous recommendation		
Observation		

Learning outcome 3.2: Record the work process

 **Duration: 1hour**

Learning outcome 3.2 objectives :

By the end of the learning outcome, the trainees will be able to:

- Describe the work carried out

 **Resources**

Equipment	Tools	Materials
- Flipchart - Computer - Projector	-Eraser -Board	- Pen - Internet - Books and handouts - Markers - Chalks - Pictures - Video

 **Advance preparation:**

. Deeply understanding the description of work carried out while repairing function generator

Indicative content 3.2: Description of the work carried out

- **Description of the work carried out**

✓ **Faulty parts**: show the part of the device have a problem
✓ **Type of fault**: identify the type of fault either hardware or software
✓ **Tools, materials and Equipment used**: identify all requirement to fix fault well.
✓ **Steps and Techniques used to fix the fault:** show clearly the ways for fixing the faults on device.
✓ **Status of the device after work**: compare the status of device before repair and the status of device after repair to know if the problem is fixed well.

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on the work carried out in repairing function generator.

Practical learning Activity

- ✓ Provide students all necessary items used to make work document, ask them to describe the work carried out.

Points to Remember (Take home message)(Take home message)

<u>Description of the work carried out</u>

- ✓ Faulty parts
- ✓ Type of fault
- ✓ Tools, materials and Equipment used
- ✓ Steps and Techniques used to fix the fault
- ✓ Status of the device after work

Learning outcome 3.2 formative assessment

Written assessment

Q1. Explain the work that carried out in repairing function generator

Answer:

- ✓ **Faulty parts**: show the part of the device have a problem
- ✓ **Type of fault**: identify the type of fault either hardware or software
- ✓ **Tools, materials and Equipment used**: identify all requirement to fix fault well.
- ✓ **Steps and Techniques used to fix the fault:** show clearly the ways for fixing the faults on device.
- ✓ **Status of the device after work**: compare the status of device before repair and the status of device after repair to know if the problem is fixed well.

Practical assessment

Function Generator Of **ABC Company LTD** have got faulty component internally Which course not working well, as electronics repair Technician you are hired Test it for well know if it operation is possible after finishing all required Task you are recommended to **Record the work process**. **Note** that testing techniques, Disassembling, and assembling process must be regulated.

Learning outcome 3.3 : Write technical recommendation

 **Duration: 1hour**

Learning outcome 3.3 objectives :

By the end of the learning outcome, the trainees will be able to:

- Describe element of technical recommendation

 **Resources**

Equipment	Tools	Materials
Flipchart Computer Projector	Board Eraser	Pen Internet Books and handouts Markers Chalks

 **Advance preparation:**

Checklist	Score	
	Yes	No
Indicator: Work Document elements are well described		
✓ Repairing date		
✓ Addresses of technician		
✓ Status of DC Power supply		
✓ Name of the repaired part		
✓ Steps work carried out		
✓ Recommendation		
Indicator: The work carried out iswell described		
✓ Fixed fault		
✓ tools, materials and Equipment used		
✓ steps and techniques used to fix the fault		
Observation		

-Deeper description of elements of technical recommendation

Indicative content 3.3: Description of element of technical recommendation

- ✓ **Propose preventive strategies**

Suggesting the way to prevent future faults. Preventive maintenance aims at keeping the equipment in good operating conditions and reliable in order to avoid any breakdown. Consists in inspecting, controlling and preserving the equipment by cleaning, adjusting and replacing pieces when estimated necessary.

The different tasks of preventive maintenance should be achieved daily, weekly, monthly or annually. Preventive maintenance could be divided into two levels: periodic maintenance and predictive maintenance.

- ● **Periodic maintenance**

Both personnel using the equipment daily and the person in charge of maintenance are

Involved in condition-monitoring tasks in a routine way.

- ● **Possible method for periodic preventive maintenance**

Documents such as follow-up forms have to be elaborated beforehand

The person in charge of maintenance completes periodically the follow-up forms

Any instrument should also be provided with its own maintenance book, where specific actions can be described precisely.

- **Predictive maintenance**

The person in charge of maintenance is also involved in life-extending tasks, which have to be scheduled regularly, even if less frequent than routine, in order to prevent faults from occurring in the long-term.

The aim in this case is to identify imminent troubles and bring Solutions to prevent equipment from failing, mainly by inspecting and then correcting, Adjusting and/or replacing parts.

- ✓ **Suggest solutions to faced challenges:**

Find the way to get solution to against future faults. In a well-managed maintenance system, all inspections done during preventive or corrective maintenance should be listed, recorded and archived every year in order to provide long term monitoring.

Corrective maintenance is systematically done after a mechanical or electrical failure. It aims at quickly restoring the equipment and making it reliable again. This action consists in analysing the problem and solving it, generally by replacing pieces when possible.

- ✓ **Propose the periodic check-up:**

Elaborate how you can prevent faults by doing frequently maintenance to avoid faults .Both personnel using the equipment daily and the person in charge of periodic check-up are involved in condition-monitoring tasks in a repetitive way.

- **Possible method for periodic check-up**

Documents such as follow-up forms have to be elaborated beforehand

The person in charge of maintenance completes periodically the follow-up forms

Any instrument should also be provided with its own maintenance book, where specific actions can be described precisely.

Theoretical learning Activity

- ✓ Conduct brainstorming session with the student on technical recommendation

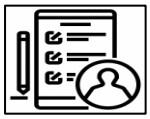
Practical learning Activity

- ✓ Provide students all necessary items used to make work document, ask them to describe the elements of technical recommendation.

Points to Remember (Take home message)

Propose preventive strategies:

suggesting the way to prevent future faults. Preventive maintenance aims at keeping the equipment in good operating conditions and reliable in order to avoid any breakdown. consists in inspecting, controlling and preserving the equipment by cleaning, adjusting and also replacing pieces when estimated necessary.



Learning outcome 3.3 formative assessment

Written assessment

Q1. Explain the term “Propose preventive strategies”.

Answer:

suggesting is the way to prevent future faults. Preventive maintenance aims at keeping the equipment in good operating conditions and reliable in order to avoid any breakdown. consists in inspecting, controlling and preserving the equipment by cleaning, adjusting and also replacing pieces when estimated necessary.

Q2. Describe the elements of technical recommendation

Answer:

- Propose preventive strategies
- Suggest solutions to faced challenges
- Propose the periodic check-up

Checklist	Score	
	Yes	No
Indicator: element of technical recommendation are well described		
✓ Propose preventive strategies		
✓ Suggest solutions to faced challenges		
✓ Propose the periodic check up		
Observation		

Practical assessment

Function Generator Of **ABC Company LTD** have got faulty component internally Which course not working well, as electronics repair Technician you are hired Test it for well know if it operation is possible after finishing all required Task you are recommended to **Write technical recommendation**. **Note** that testing techniques, Disassembling, and assembling process must be regulated

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Electronics. Electrical technology,Volume2,B.L Theraja