Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ESSCI

Participant Handbook

Sector
Electronics

Sub-Sector
Consumer Electronics

Occupation
After Sales Service

Reference ID: **ELE/Q3101 Version 1.0**
NSQF Level : 4

TV Repair Technician

Published by

First Edition, May 2016

Printed in India at

Electronics Sector Skill Council of India (ESSCI)

Sector Skill Council Contact Details:

602,604,606,608, Ansal Chamber-II, Bhikaji Cama Place, New Delhi-110066

Email : info@essc-india.org

Phone : +91-11-46035050

Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India

Certificate

COMPLIANCE TO
QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

ELECTRONICS SECTOR SKILL COUNCIL OF INDIA

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/Qualification Pack: **TV Repair Technician QP No. 'ELE/Q3101, Version 1.0 NSQF Level 4'**

Date of Issuance: April 9th, 2016
Valid up to*: April 10th, 2018

*Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)

Authorized Signatory
Electronics Sector Skill Council of India

Acknowledgement

1. Standard books on Electricity, Electronics and Television Technology
2. Own experience and learning in the Television Industry
3. Own Skills
4. Websites

About this Guide

Skill India is a mission to skill the youth of India so that they are suitably employed and help to carry our great nation forward. This book aims to upgrade skills of Television technicians and engineers, supervisors and managers working in organized or unorganized sectors in After Sales service, production or quality control and can be used as a hand book.

This book has been especially written as per QP ELE/Q3101 and as per NOS prepared by ESSCI and NSDC under Ministry of Skill Development and Enterpreneurship.

Having worked in the Consumer Electronics field since long, I am aware of the difficulties faced by such technicians. So, Basic Electronics has been explained in a simple and easy to understand language.

This book has been divided into chapters. We take up the concepts of Physics, Basics of Electricity, Semi Conductors. We then take the student through signal transmission and reception.

After going through these chapters, one can easily understand working principles of TV and LCD / LED TVs, their installation and demonstration and finally their trouble shooting.

As per QP, we have also included chapters on Soft Skills and Communication Skills as in today's competitive environment, soft skills play a major role in After Sales Service.

As per QP, more emphasis in this book is on practical learning and doing along with the theory. We strongly warn that no attempt should be made by any one to try repair of any CRT or LCD / LED TV or any electronic gadget only by reading this book. This is only a guide book and the student should try repair only after doing a certified course from any authorized Training Partner with NSDC or any other certified Training Agency and under the watchful supervision of a certified Trainer

Author

Symbols Used


Learning Outcomes


Steps


Time


Tips


Notes


Objectives


Exercise


Activity

Table of Contents

Table of Contents

Table of Contents

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ESSCI

1. Introduction

Unit 1.1 - Introduction to the course

Unit1.2 - What you will learn

ELE/Q3101

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain scope of the course
2. Explain expected outcome from the course

UNIT 1.1: Introduction to the Course

Unit Objectives

At the end of this unit you will be able to:

1. Explain scope of the course

This Participant handbook is designed as a stand-alone reference manual for technicians working in the Television industry. It begins with basics of electrical and electronics theory and ends up in giving a overview and repairing techniques of CRT and Flat panel based Television system with the safety guidelines. As the industry is increasingly finding that Soft Skills and Communication skills are also very important along with hard skills, these have also been covered in this book. Tips on how to troubleshoot common problems are also provided. These lessons are primarily text-based with some illustrations.This handbook may be used either on its own or as an integral part of a classroom course including practical work to enable the student to progress to assessment and certification. We hope you and your career benefit greatly from this handbook and associated training course.

UNIT 1.2: What you will learn

Unit Objectives

At the end of this unit you will be able to:

1. Explain what should be expected for the course

You will learn after going through this course

1. Basic Electronics-Working of resistance, inductance, capacitance, diode, transistors, FET and MOSFET
2. Understand theory behind Television working.
3. Installation of Television at appropriate location
4. Servicing or Faultfinding and repair of CRT and Flat panel Television system
5. Understanding the safety requirements before installing
6. Interact with Customer in a friendly way-Soft and communication Skills
7. Interacting with superiors and understanding the company policies- Soft Skills and Communication Skills
8. Documentations and its importance

Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

ESSCI

2. Basics of Electrical and Electronics Theory

ELE/Q3101

Key Learning Outcomes

At the end of this module, you will be able to:

1. Explain fundamentals of electricity
2. Explain series and parallel circuit
3. Calculate resistance, voltage and current in series and parallel circuit
4. Describe Ohm's and Kirchoff's law and understand its application
5. Explain various types of active components and its application
6. Explain various types of passive components and its application
7. Identify and Operate various tools and equipments

UNIT 2.1: Fundamentals of Electricity

Unit Objectives

At the end of this unit you will be able to:

1. Describe electricity
2. Explain how electricity works

What is electricity:
Electricity is the flow of moving electrons. When the electrons flow it is called anelectrical current. To understand why electrons flow you need to understand that atoms can lose electrons by rubbing against another material.

How does the electricity work:
A current of electricity is a steady flow of electrons. When electrons move from one place to another, round a circuit, they carry electrical energy from place to place like marching ants carrying leaves. Instead of carrying leaves, electrons carry a tiny amount of electric charge

How many electrons will flow in 1 amp?
Current flows from negatively charged material to positively charged material and is essentially the number of electrons per second that are carried through a conductor. Current is measured in units of amps. 1 amp = 1 coloumb/sec = 6.2 x 1018 electrons per second

UNIT 2.2: Current Voltage and Power

Unit Objectives

At the end of this unit you will be able to:

1. Explain what is current, voltage and power
2. Explain series and parallel circuit

2.2.1: Current, Voltage and Power:

- Electricity is the flow of electric charge. We can describe the flow of electric charge in several ways. These include the quantities Current,Voltage and Power.

- Current (I) is the rate of flow of Charge, such as electrons. Current is usually thought of as moving in the direction of positive charge, so from the positive power supply to the negative. However, since in metals it is electrons that carry electric charge, the actual flow is opposite to the way in which we think of it.
  I=dq/dt

- Current: It is the amount of Charge, Q that passes a point in a set time, t. So, we say it is the rate of flow of charge. Current is measured in Amps (A), and charge is measured in Coulombs (C).

- Voltage (V) or Potential Difference (P.D.) is a measure of the Energytransferred per Charge Carrier between two points.
  V=E/Q

- Voltage is the Energy E per Charge Q. Voltage is measured in Volts (V), which is defined as one Joule per Coulomb. Voltage can be defined in base units as Kgm2s-3A-1.

- Power (P) is the rate of Energy transfer. It is measured in watts (W), where one watt is defined as one Joule per Second. Hence watts can be expressed in base units as Kgm2s-3
  - Power P=Energy/Time
  - 1W=1 Joule/Second

- From this definition of Power, we can substitute the algebraic definitionsabove to produce a variety of other formulae, including 'Power = Current × Voltage'
  P=I*V

- Ohm's Law states that " Current flowing in a conductor is directly proportional to the voltage applied across the conductor subject to following conditions

  1. Temperature remains constant
  2. This equation applies to both Alternating and direct Currents
  3. It does not apply to certain semiconductors like Tunnel diode which works on Negative Resistance.

- It is written as : $V \alpha I$
- When we remove the proportional sign, we get,
- $V=I*R$
- Voltage = Current × Resistance'. R is a constant.
- Here V is in Volts
- I is in Amperes
- R is in Ohms

Power: Its equation is :
$P=V*I$

- We can also write above equation as
- $P=I*R*I$
- Or $P =I*I*R=I^2R$
- We use this equation to find out power losses like :Heat losses in a circuit. We can also write this equationas

$P=(V^2/R^2)*R=V^2/R$
Example 1:
Find Resistance when V=220 Volts, I=2 Amperes
Solution 1: R=V/I
=220/2=110 Ohms
Example 2: Find Heat Loss in a light bulb where V=220V, I= 0.25 Amperes
Solution: Heat Loss=V*I=220*0.25=220*(¼)=55W

UNIT 2.3: Circuits in Series and Parellal

Unit Objectives

At the end of this unit you will be able to:

1. Calculate resistance and voltage in series and parallel circuit

2.3.1: Resistance in Series:

Resistance in Series:

R=R1+R2+R3+--------Where R1, R2, R3 are connected in Series

Example: R1 is 10 Ohms, R2 is 100 Ohms and R3 is 1000 Ohms

R=10+100+1000=1110 Ohms or 1.11K

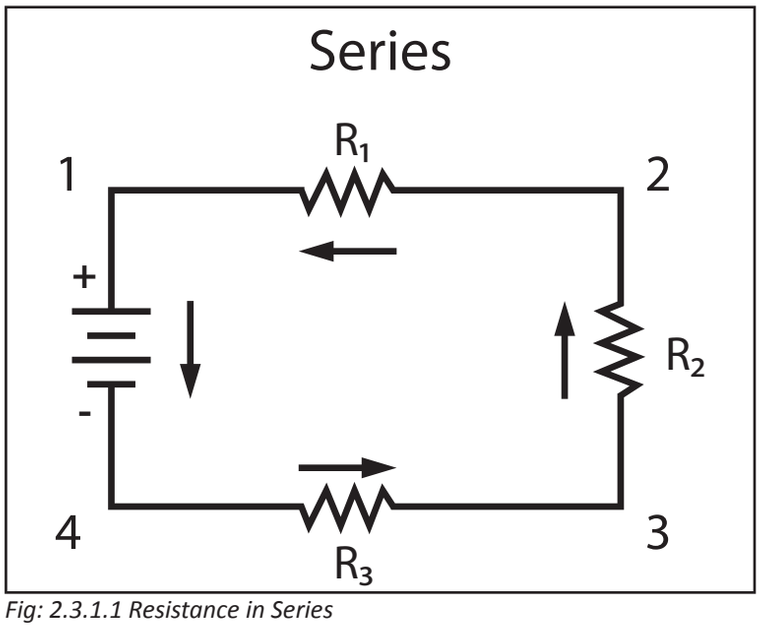


Fig: 2.3.1.1 Resistance in Series

Resistance in Parallel:

1/R=1/R1+1/R2+1/R3+--------

Example:

R1 is 100 Ohms and R2 is also 100 Ohms

I/R=1/100+1/100=2/100=1/50

So R=50 Ohms

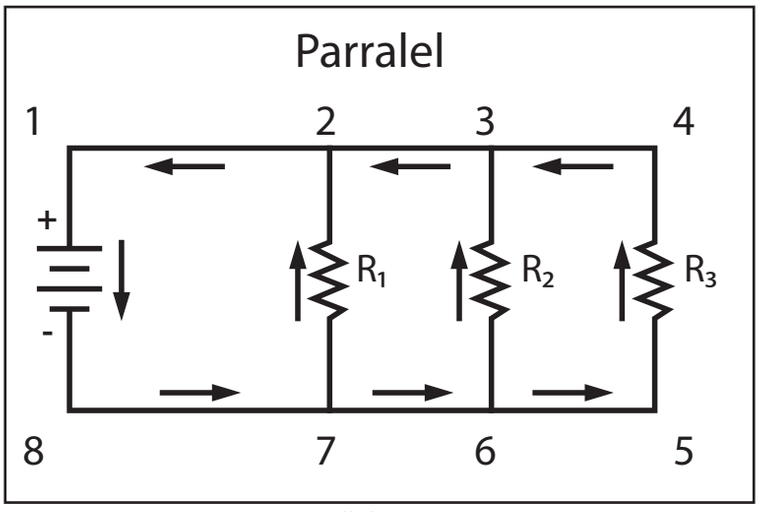


Fig: 2.3.1.2 Resistance in Parallel

Voltage in Series:

- The total voltage of several voltage sources or voltage drops in series is their sum.
- VT = V1 + V2 + V3 +...
- VT - the equivalent voltage source or voltage drop in volts (V).
- V1 - voltage source or voltage drop in volts (V).
- V2 - voltage source or voltage drop in volts (V).
- V3 - voltage source or voltage drop in volts (V).

Voltage in Parallel:

- Voltage sources or voltage drops in parallel have equal voltage.
- VT = V1 = V2 = V3 =...
- VT - the equivalent voltage source or voltage drop in volts (V).
- V1 - voltage source or voltage drop in volts (V).
- V2 - voltage source or voltage drop in volts (V).
- V3 - voltage source or voltage drop in volts (V).

- For electrical circuit with resistors (or other impedance) in series, the voltage drop Vi on resistor Ri is:

- Vi=Vt.Ri / (Ri+Rj+Rk), where Ri, Rj and Rk are three resistances in series in a circuit and Vt is the Total Voltage in the circuit.

Example:

- If Vt=12 V
- Ri=2 Ohm
- Rj=4Ohm
- Rk=6 Ohm
- Then Vi=(12*2)/ 12=2 Volts
- Vj=(12*4)/ 12=4 Volts
- Vk=12*6/12=6 Volts

UNIT 2.4: Ohms' Law and Kirchoff's Law

Unit Objectives

At the end of this unit you will be able to:

1. Explain Ohms law and its application in calculating Voltage, Resistance and Current
2. Explain Kirchoff's current law (KCL)
3. Explain Kirchoff's voltage law (KVL)

2.4.1: Ohm's Law:

GS Ohm discovered a law which tells us the relation between Voltage and current in a conductor. It applies equally to AC and DC subject to certain limitations.

It states that if there is a conductor with a potential difference of V Volts between its two terminals and a current I Amperes flows in the conductor, then the current is directly proportional to the potential difference and is shown as :

$V \alpha I$, subject to the condition that temperature remains constant .

Thus $V=I*R$

Where R is a constant and is called Resistance and is depicted by ''R''. Its SI unit is Ohm while current I is in Ampere and potential difference V is in Volts.

resistance increases with increase in temperature such that $Rt=R0(1+\alpha t)$.

Example:

If Voltage=220 Volts and Current is 2 Amperes, Resistance R is R=V/I

R=220/2=110 Ohms

The other limitation to this law is that this law does not apply to certain semi conductors which show negative resistance charcterstics

2.4.2: Direct and Alternating Currents:

Current is also defined as Rate of flow of charge. It can be shown as I=Q/T

Or di=dq/dt

If the current flows in one direction only, it is called Direct Current. We get it from DC Generators, cells, batteries or we rectify AC to get DC and use in Electronic Circuits.

2.4.3: Alterating Current:

It is so called because in it flow of electrons changes directions.

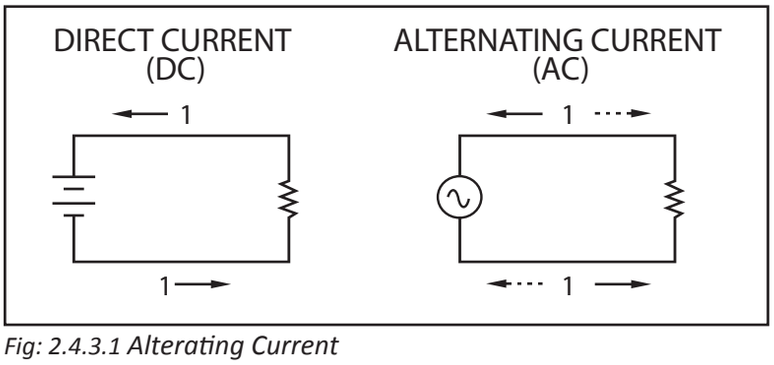


Fig: 2.4.3.1 Alterating Current

Kirchoffs Laws:

Current Law (KCL)

The total current entering a junction will be equal to the total current leaving the junction. So, the algebraic sum of all currents entering and leaving a node must be equal to zero, I outgoing +I incoming=0.

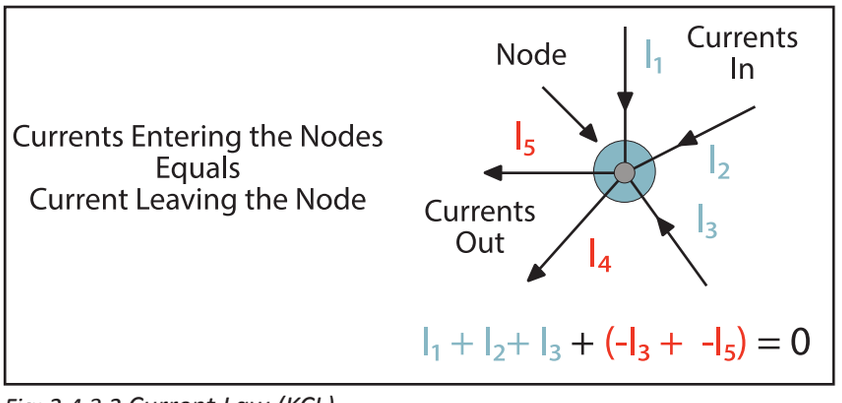


Fig: 2.4.3.2 Current Law (KCL)

It can be read as :

Total current entering a junction=Total current leaving a junction

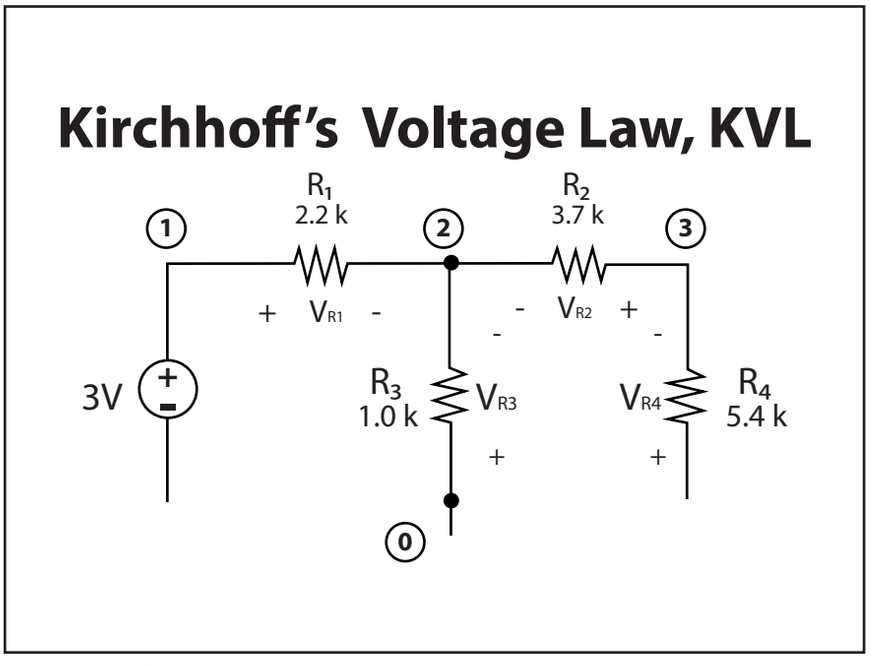


Fig: 2.4.3.3 Kirchhoff's voltage law, kvl

UNIT 2.5: Passive and Active Devices

Unit Objectives

At the end of this unit you will be able to:

1. Explain concept of Active components
2. Explain concept of passive components

2.5.1: Passsive Devices:

Passive devices are those devices or components which do not require external source for their operation.

Example:

For example, a Diode needs 0.3 0r 0.7 V to operate but resistances do not require any such voltage for operation. I.e., when we connect a resistor to the supply voltage, it starts work without any specific voltage. So, these are components which store or maintain energy in the form of Voltage or Current.

Active Components:

These devices or components require external source for their operation and these are called Active Components.

For Example: Diode, Transistors, SCR, IC, FET, MOSFET etc.

Example: As we know that Diode is an Active Component, so it requires an External Voltage for its operation.

The reason is that If we connect a Diode in a Circuit and then connect this circuit to the Supply voltage., then Diode will conduct the current only if the supply voltageis 0.3 V (In case of Germanium) or 0.7V(In case of Silicon). So, Active Components are :

Those devices or components which produce energy in the form of Voltage or Current are called as Active Components.

UNIT 2.6: Passive Devices-Resistor, Capacitor, Inductor

Unit Objectives

At the end of this unit you will be able to:

1. Explain concept of resister, capacitor and inductors
2. Calculate resistance of resister based on colour coding
3. Calculate inductance in series and parallel circuit
4. Calculate capacitance in series and parallel circuit
5. Explain various types of capacitor and its application

2.6.1: Resistor or Resistance:

Resistor or Resistance:

The resistance may be available from 1 Ohm or even less to several Meg Ohms. It is therefore important to have a code so that by seeing the code a technician may be able to find the value of the resistor. We have here given a Table for these codes:

Resistance Codes:

Colour First Letter	Colour	Code
B	Black	0
B	Brown	1
R	Red	2
O	Orange	3
Y	Yellow	4
G	Green	5
B	Blue	6
V	Violet	7
G	Grey	8
W	White	9

Tab: 2.6.1 Resistance Codes

The method to memorise the code is '' BB ROY of Great Britain had a Very Good Wife.'' If there are 5 bands on the resistor, its value can be found as follows:

Ist colour band from left: Value to be taken from the above table.

2nd colour band from left :Value to be taken from above table.

3rd colour band from left :Value to be taken from the above table.

4th colour band from left: is the Multiplier (10 to the power)

5th colour band : It is for Tolerance as under:

Silver 5%

Gold 10%

No colour or body colour 20%

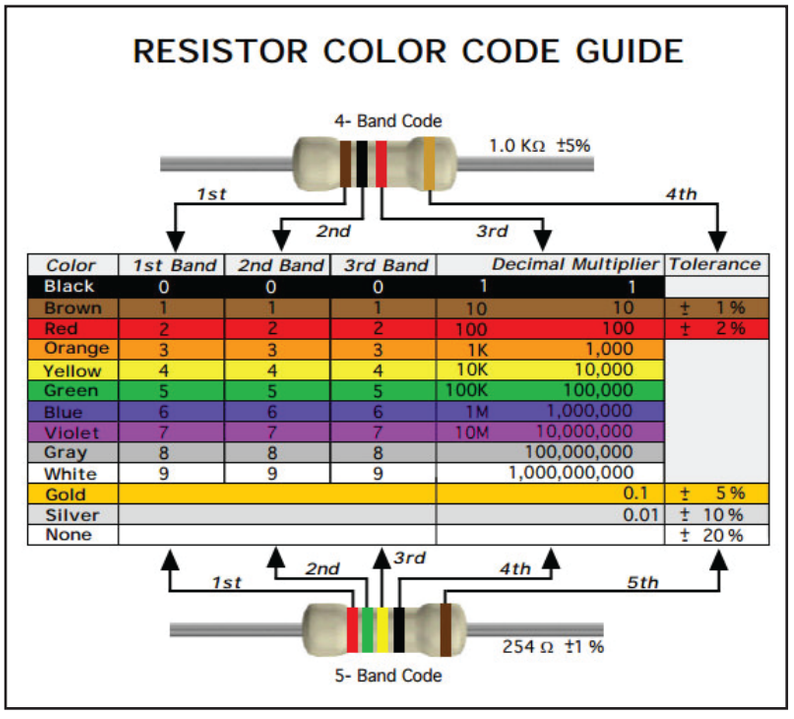


Fig: 2.6.1.1 Resistor Colour Code

Examples:

Example #1

A resistor colored Yellow-Violet-Orange-Gold would be 47 kΩ with a tolerance of +/- 5%.

Example #2

A resistor colored Green-Red-Gold-Silver would be 5.2 Ω with a tolerance of +/- 10%.

Example #3

A resistor colored White-Violet-Black would be 97 Ω with a tolerance of +/- 20%. When you see only three color bands on a resistor, you know that it is actually a 4-band code with a blank (20%) tolerance band.

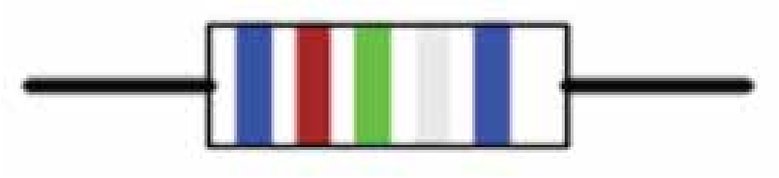
Example #4

A resistor colored Orange-Orange-Black-Brown-Violet would be 3.3 kΩ with a tolerance of +/- 0.1%.

Example #5

A resistor colored Brown-Green-Grey-Silver-Red would be 1.58 Ω with a tolerance of +/- 2%.

Example #6



A resistor colored Blue-Brown-Green-Silver-Blue would be 6.15 Ω with a tolerance of +/- 0.25%.

Thus, knowledge of colour code helps us in finding the value of the resistance and it is very useful in TV repair.

Domestic Wiring:

In a series circuit, if one component is open, the circuit breaks and there is no current flow. It is because in Series, same current flows while in Parallel, there are branches and so current is divided while Voltage remains same.

This principle is used in Domestic wiring. The wiring is done in Series so that if one appliance becomes defective (open circuit) because of any reason, the current in other house hold appliances is not interrupted.

Inductance:

Inductance is the characteristic of a device which resists change in the current through the device. Inductors work on the principle that when a current flows in a coil of wire, a magnetic field is produced, which collapses when the current is stopped. The collapsing magnetic field produces an electromotive force which tries to maintain the current. When the coil current is switched, the induced EMF would be produced in such a direction, so as to oppose the build-up of the current.