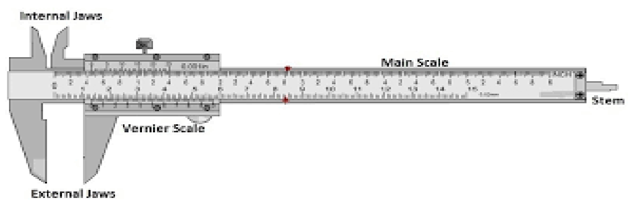
Lab Equipment Training

Mrs.R.Arulmozhi, Assistant Professor of Physics

Vernier Caliper:

Vernier Caliper is a measuring device or instrument that is used for the measurement of linear dimensions. It is used for measuring the distance between two opposite sides of a surface (i.e.) we can measure the internal and external dimensions. It is based on a vernier scale which is used in the laboratory to measure lengths of objects. It has a main scale (in millimetres) and a sliding vernier scale.



A Vernier consists of Main Scale, and a Vernier Scale that can able to slide on the scale. The vernier caliper least count is the difference between one Main Scale Division (M.S.D) and one Vernier Scale Division (V.S.D). Therefore, the least count of vernier calliper is 0.1 mm or 0.01cm.When there are n divisions on the vernier scale, which coincides with (n-1) division on the main scale, then the least count of vernier calliper is calculated as:

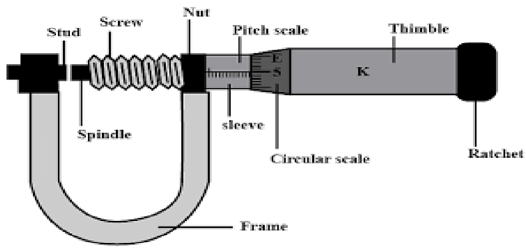
$$LC = \frac{n-1}{n} MSD$$

The formula to find the diameter of the component is

Main Scale Reading + (Vernier Scale Reading X Least Count)

Screw Gauge:

It is an instrument that is used for measuring the diameter of thin wires and the thickness of small objects such as spherical or cylindrical objects.



There are two scales named as Pitch Scale and Circular or Head Scale.

The Least Count of Screw Gauge is 0.001cm. It can be calculated as:

$$L.C= \frac{Value\ of\ one\ Pitch\ Scale\ reading}{Total\ nuber\ of\ Head\ Scale Divisions}$$

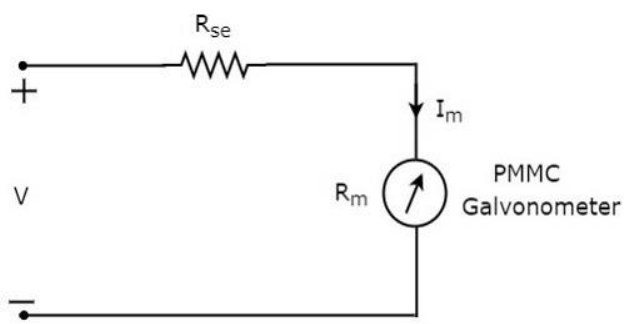
= 1mm/100 = 0.01mm = (0.01/10)cm = 0.001cm

Total Reading = Pitch Scale Reading + Circular Scale Reading x LC of the gauge

DC Voltmeter:

DC voltmeter is a measuring instrument, which is used to measure the DC voltage across any two points of electric circuit. If we place a resistor in series with the Permanent Magnet Moving Coil (PMMC) galvanometer, then the entire combination together acts as DC voltmeter.

The series resistance, which is used in DC voltmeter, is also called series multiplier resistance or simply, multiplier. It basically limits the amount of current that flows through galvanometer in order to prevent the meter current from exceeding the full scale deflection value. The circuit diagram of DC voltmeter is shown in below figure.



We have to place this DC voltmeter across the two points of an electric circuit, where the DC voltage is to be measured.

Apply KVL around the loop of above circuit.

$$V - I_m R_{se} - I_m R_m = 0 \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$\Rightarrow V - I_m R_m = I_m R_{se}$$

$$\Rightarrow R_{se} = V - I_m R_m / I_m$$

$$\Rightarrow R_{se} = V/I_m - R_m \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Where, R_{se} is the series multiplier resistance

Vis the full range DC voltage that is to be measured

I_m is the full scale deflection current

R_m is the internal resistance of galvanometer

The ratio of full range DC voltage that is to be measured, V and the DC voltage drop across the galvanometer, V_m is known as multiplying factor, m. Mathematically, it can be represented as

$$m = V/Vm \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

From Equation 1, we will get the following equation for full range DC voltage that is to be measured, V.

$$V = I_m R_{se} + I_m R_m \ \ldots\ldots\ldots\ldots\ldots\ldots(4)$$

The DC voltage drop across the galvanometer, Vm is the product of full scale deflection current, Im and internal resistance of galvanometer, Rm. Mathematically, it can be written as

$$V_m = I_m R_m V_m = I_m R_m \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

Substitute, Eqn(4) and Eqn(5) in Eqn(3).

$$M = I_m R_{se} + I_m R_m / \ I_m R_m$$

$$\Rightarrow m = R_{se}/R_m + 1$$

$$\Rightarrow m - 1 = R_{se} / \ R_m$$

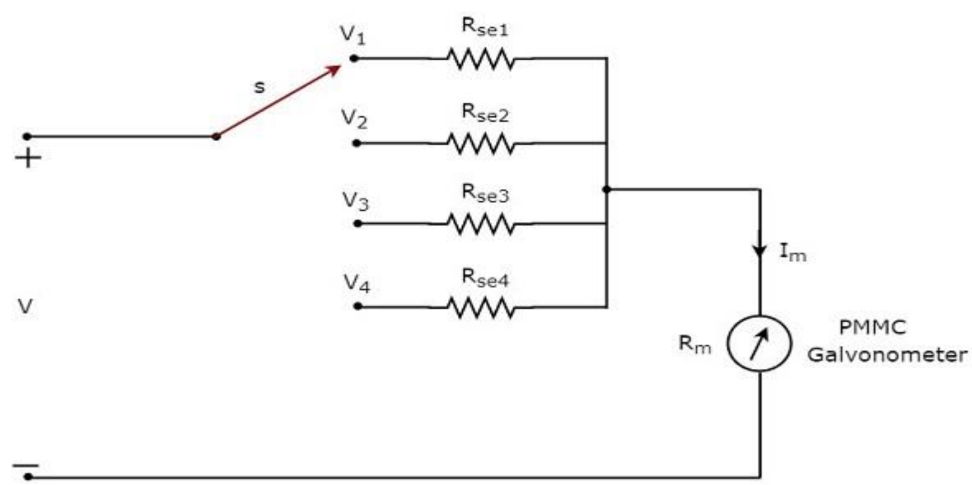
$$R_{se} = R_m(m-1) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(6)$$

We can find the value of series multiplier resistance by using either Eq(2) or Eqn(6) based on the available data.

DC Multimeter (Multi Range DC Voltmeter):

DC voltmeteris obtained by placing a multiplier resistor in series with the PMMC galvanometer. This DC voltmeter can be used to measure a particular range of DC voltages.

If we want to use the DC voltmeter for measuring the DC voltages of multiple ranges, then we have to use multiple parallel multiplier resistors instead of single multiplier resistor and this entire combination of resistors is in series with the PMMC galvanometer. The circuit diagram of multi range DC voltmeter is shown in below figure.



We have to place this multi range DC voltmeter across the two points of an electric circuit, where the DC voltage of required range is to be measured. We can choose the desired range of voltages by connecting the switch s to the respective multiplier resistor.

Let, m_1, m_2, m_3 and m_4 are the multiplying factors of DC voltmeter when we consider the full range DC voltages to be measured as, V_1, V_2, V_3 and V_4 respectively. Following are the formulae corresponding to each multiplying factor.

$$m_1 = V_1 / V_m$$

$$m_2 = V_2 / V_m$$

$$m_3 = V_3 / V_m$$

$$m_4 = V_4 / V_m$$

In above circuit, there are four series multiplier resistors, R_{se1}, R_{se2}, R_{se3} and R_{se4}.Following are the formulae corresponding to these four resistors.

$$R_{se1} = R_m(m_1 - 1)$$

$$R_{se2} = R_m(m_2 - 1)$$

$$R_{se3} = R_m(m_3 - 1)$$

$$R_{se4} = R_m(m_4 - 1)$$

So, we can find the resistance values of each series multiplier resistor by using above formulae.

AC voltmeter:

The instrument, which is used to measure the AC voltage across any two points of electric circuit, is called AC voltmeter. If the AC voltmeter consists of rectifier, then it is said to be rectifier based AC voltmeter.

The DC voltmeter measures only DC voltages. If we want to use it for measuring AC voltages, then we have to follow these two steps.

- Step1 – Convert the AC voltage signal into a DC voltage signal by using a rectifier.
- Step2 – Measure the DC or average value of the rectifier's output signal.

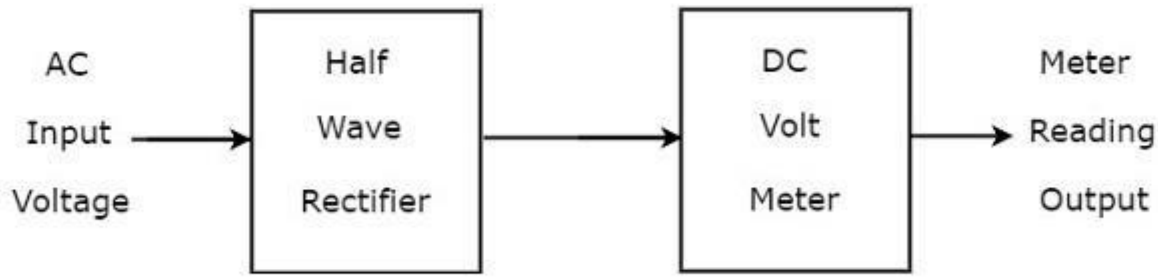
We get Rectifier based AC voltmeter, just by including the rectifier circuit to the basic DC voltmeter.

Types:

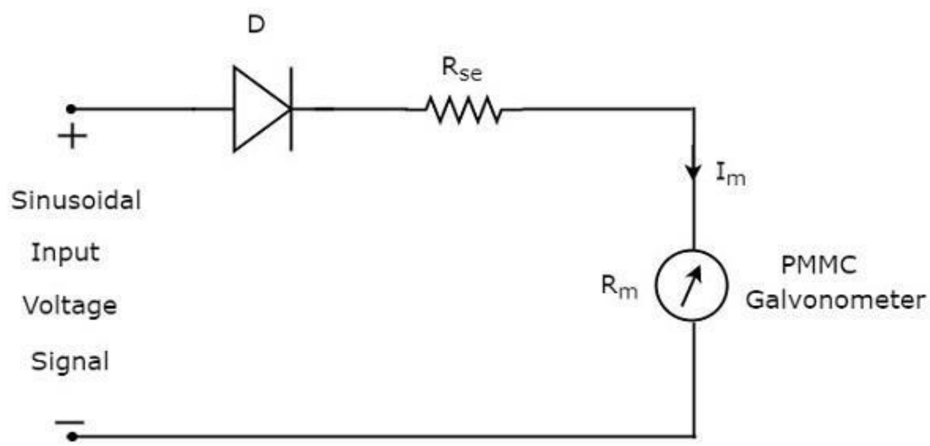
- AC voltmeter using Half Wave Rectifier
- AC voltmeter using Full Wave Rectifier

AC Voltmeter using Half Wave Rectifier:

If a half wave rectifier is connected ahead of DC voltmeter, then that entire combination together is called AC voltmeter using half wave rectifier. The block diagram of AC voltmeter using half wave rectifier is shown in below figure.



The above block diagram consists of two blocks: half wave rectifier and DC voltmeter. We will get the corresponding circuit diagram, just by replacing each block with the respective component(s) in above block diagram. So, the circuit diagram of AC voltmeter using half wave rectifier will look like as shown in below figure.



The rms value of sinusoidal (AC) input voltage signal is

$$V_{rms} = \frac{V_m}{\sqrt{2}}$$

$$\Rightarrow V_m = \sqrt{2} V_{rms}$$

$$\Rightarrow V_m = 1.414 V_{rms}$$

Where, V_m is the maximum value of sinusoidal (AC) input voltage signal.

The DC or average value of the half wave rectifier's output signal is

$$V_{dc} = \frac{V_m}{\pi}$$

Substitute, the value of V_m in above equation,

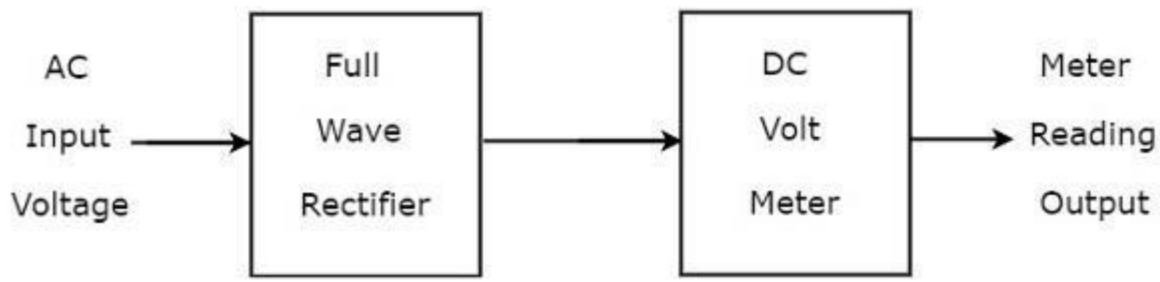
$$V_{dc}=1.414V_{rms}/\pi$$

$$V_{dc}=0.45V_{rms}$$

Therefore, the AC voltmeter produces an output voltage, which is equal to 0.45 times the rms value of the sinusoidal (AC) input voltage signal.

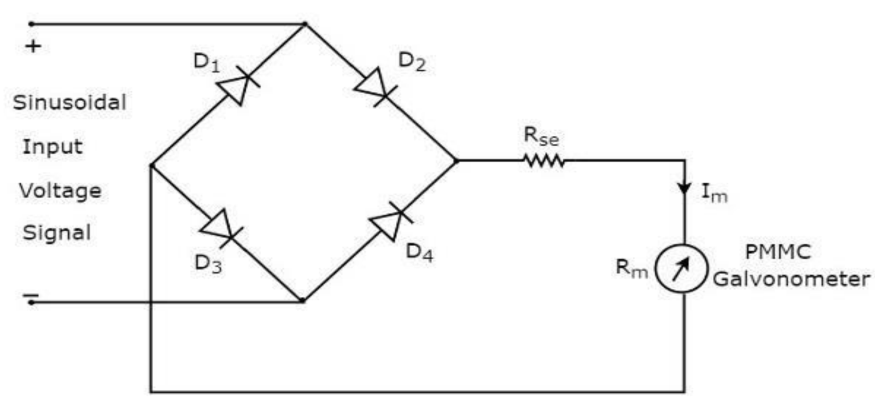
AC Voltmeter using Full Wave Rectifier:

If a Full wave rectifier is connected ahead of DC voltmeter, then that entire combination together is called AC voltmeter using full wave rectifier. The block diagram of AC voltmeter using full wave rectifier is shown in below figure.



The above block diagram consists of two blocks: full wave rectifier and DC voltmeter. We will get the corresponding circuit diagram just by replacing each block with the respective component(s) in above block diagram.

So, the circuit diagram of AC voltmeter using Full wave rectifier will look like as shown in below figure.



The rms value of sinusoidal (AC) input voltage signal is

$$V_{rms} = \frac{V_m}{\sqrt{2}}$$

$$\Rightarrow V_m = \sqrt{2} V_{rms}$$

$$\Rightarrow V_m = 1.414 V_{rms}$$

The DC or average value of the Full wave rectifier's output signal is

$$V_{dc} = \frac{2V_m}{\pi}$$

Substitute, the value of V_m in above equation,

$$V_{dc} = \frac{2 \times 1.414 Vrms}{\pi}$$

$$V_{dc} = 0.9 V_{rms}$$

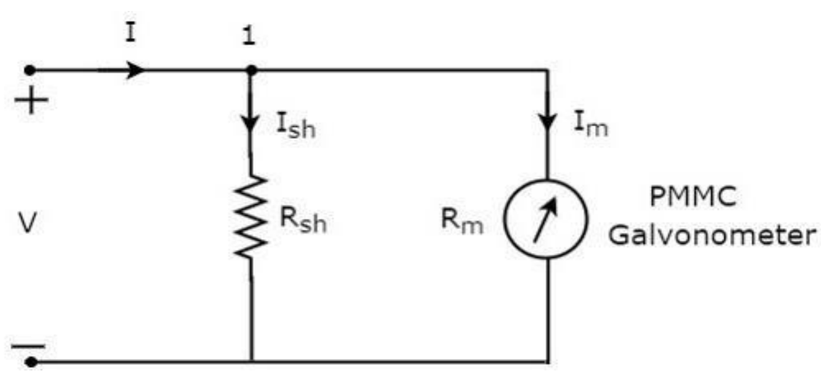
Therefore, the AC voltmeter produces an output voltage, which is equal to 0.9 times the rms value of the sinusoidal (AC) input voltage signal.

DC Ammeter:

Current is the rate of flow of electric charge. If this electric charge flows only in one direction, then the resultant current is called Direct Current (DC). The instrument, which is used to measure the Direct Current called DC ammeter.

If we place a resistor in parallel with the Permanent Magnet Moving Coil (PMMC) galvanometer, then the entire combination acts as DC ammeter. The parallel resistance, which is used in DC ammeter is also called shunt resistance or simply, shunt. The value of this resistance should be considered small in order to measure the DC current of large value.

The circuit diagram of DC ammeter is shown in below figure.



We have to place this DC ammeter in series with the branch of an electric circuit, where the DC current is to be measured. The voltage across the elements, which are connected in parallel, is same. So, the voltage across shunt resistor, R_{sh} and the voltage across galvanometer resistance, R_m is same, since those two elements are connected in parallel in above circuit. Mathematically, it can be written as

$$I_{sh}R_{sh} = I_m R_m$$

$$R_{sh} = I_m R_m / I_{sh} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

The KCL equation at node 1 is

$$-I + I_{sh} + I_m = 0$$

$\Rightarrow I_{sh} = I - I_m$

Substitute the value of I_{sh} in eqn (1).

$$R_{sh} = I_m R_m / (I - I_m) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Take, I_m as common in the denominator term, which is present in the right hand side of eqn (2)

$$R_{sh} = \frac{I_m R_m}{I_m \left(\frac{1}{I_m} - 1\right)}$$

$$\Rightarrow R_{sh} = \frac{R_m}{\left(\frac{1}{I_m} - 1\right)} \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where,

R_{sh} is the shunt resistance

R_m is the internal resistance of galvanometer

Iis the total Direct Current that is to be measured

I_m is the full scale deflection current

The ratio of total Direct Current Iand the full scale deflection current of the galvanometer, I_m is known as multiplying factor, m. Mathematically, it can be represented as

$$m = I / I_m \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$R_{sh} = R_m / (m-1) \quad \ldots\ldots\ldots\ldots\ldots\ldots(5)$$

We can find the value of shunt resistance by using either Eqn(2) or Eqn(5) based on the available data.

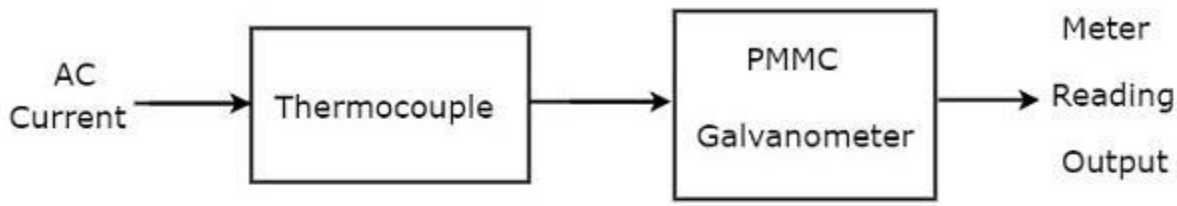
AC Ammeter:

Current is the rate of flow of electric charge. If the direction of this electric charge changes regularly, then the resultant current is called Alternating Current (AC).The instrument, which is used to measure the Alternating Current that flows through any branch of electric circuit is called AC ammeter.

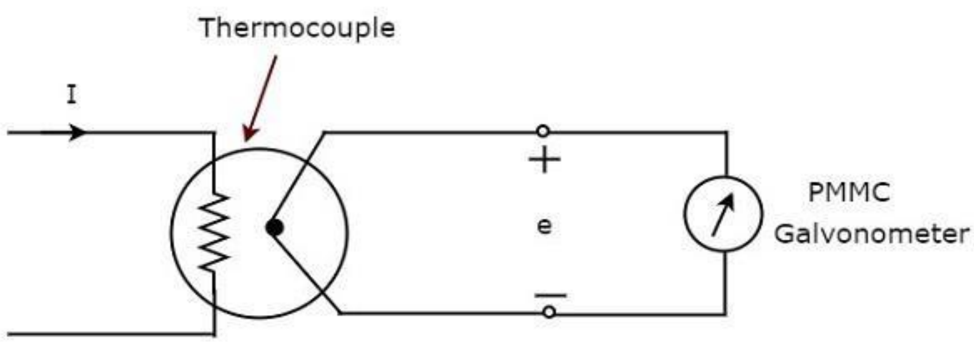
Ex: Thermocouple type AC ammeter.

Thermocouple Type AC Ammeter:

If a Thermocouple is connected ahead of PMMC galvanometer, then that entire combination is called thermocouple type AC ammeter. The block diagram of thermocouple type AC ammeter is shown in figure.



The above block diagram consists of mainly two blocks: a thermocouple, and a PMMC galvanometer. We will get the corresponding circuit diagram, just by replacing each block with the respective component(s) in above block diagram. So, the circuit diagram of thermocouple type AC ammeter will look like as shown in figure.



Thermocouple generates an EMF, e, whenever the Alternating Current, I flows through heater element. This EMF, e is directly proportional to the rms value of the current, I that is flowing through heater element. So, we have to calibrate the scale of PMMC instrument to read rms values of current.

Multimeters:

A multimeter, also known as a volt-ohm meter, is a handheld tester used to measure electrical voltage, current (amperage), resistance, and other values. Multimeters come in analog and digital versions and are useful for everything from simple tests, like measuring battery voltage, to detecting faults and complex diagnostics. They are one of the tools preferred by electricians for troubleshooting electrical problems on motors, appliances, circuits, power supplies, and wiring systems.

How to use Multimeters?

The basic functions and operations of a multimeter are similar for both digital and analog testers. The tester has two leads—red and black—and three ports. The black lead plugs into the "common" port. The red lead plugs into either of the other ports, depending on the desired function.

After plugging in the leads, you turn the knob in the center of the tester to select the function and appropriate range for the specific test. For example, when the knob is set to "20V DC," the tester will detect DC (direct current) voltage up to 20 volts. To measure smaller voltages, you would set the knob to the 2V or 200Mv range.

To take a reading, you touch the bare metal pointed end of each lead to one of the terminals or wires to be tested. The voltage (or other value) will read out on the tester. Multimeters are safe to use on energized circuits and equipment, provided the voltage or current does not exceed the maximum rating of the tester. Also, you must be careful never to touch the bare metal ends of the tester leads during an energized test because you can receive an electrical shock.

Multimeter Functions:

Multimeters are capable of many different readings, depending on the model. Basic testers measure voltage, amperage, and resistance and can be used to check continuity, a simple test to verify a complete circuit. More advanced multimeters may test for all of the following values:

- AC (alternating current) voltage and ampere
- DC (direct current) voltage and ampere
- Resistance (ohms)
- Capacity (farads)
- Conductance (12iemens)
- Decibels
- Duty cycle
- Frequency (Hz)
- Inductance (henrys)
- Temperature Celsius or Fahrenheit

Accessories or special sensors can be attached to some multimeters for additional readings, such as:

- Light level
- Acidity
- Alkalinity
- Wind speed
- Relative humidity

Analog Multimeters:

An analog multimeter is based on a microammeter (a device that measures amperage, or current) and has a needle that moves over a graduated scale. Analog multimeters are less expensive than their digital counterparts but can be difficult for some users to read accurately. Also, they must be handled carefully and can be damaged if they are dropped.

Analog multimeters typically are not as accurate as digital meters when used as a voltmeter. However, analog multimeters are great for detecting slow voltage changes because you can watch the needle moving over the scale. Analog testers are exceptional when set as ammeters, due to their low resistance and high sensitivity, with scales down to 50µA (50 microamperes).

Digital Multimeters:

Digital multimeters are the most commonly available type and include simple versions as well as advanced designs for electronics engineers. In place of the moving needle and scale found on analog meters, digital meters provide readings on an LCD screen. They tend to cost more than analog multimeters, but the price difference is minimal among basic versions. Advanced testers are much more expensive.

Digital multimeters typically are better than analog in the voltmeter function, due to the higher resistance of digital. But for most users, the primary advantage of digital testers is the easy-to-read and highly accurate digital readout.

Galvanometer:

A galvanometer is an electromechanical instrument or device that is used for detecting and indicating an electric current.The current and its intensity is usually indicated by a magnetic needle's movement or that of a coil in a magnetic field that is an important part of a galvanometer.

Principle:

A current-carrying coil when placed in an external magnetic field experiences magnetic torque. The angle through which the coil is deflected due to the effect of the magnetic torque is proportional to the magnitude of current in the coil.

Spot Galvanometer:

A mirror galvanometer is an ammeter that indicates it has sensed an electric current by deflecting a light beam with a mirror. The beam of light projected on a scale acts as a long mass less pointer. The apparatus is also known as a spot galvanometer after the spot of light produced in some models.Spot galvanometer is also known as **reflecting galvanometer**. It is specially designed for the measurement of the small quantity of the current through the circuit.

Digital Frequency Meter

A digital frequency meter is an electronic instrument that can measure even the smaller value of frequency up to 3 decimals of a sinusoidal wave and displays it on the counter display. It counts the frequency periodically and can measure in the range of frequencies between 104 to

109 hertz. The entire concept is based on the conversion of sinusoidal voltage into continuous pulses (01, 1.0, 10 seconds) along a single direction.

Working Principle:

When an unknown frequency signal is applied to the meter it passes on to amplifier which amplifies the weak signal. Now the amplified signal is now applied to Schmitt trigger which can convert input sinusoidal signal into a square wave. The oscillator also generates sinusoidal waves at periodic intervals of time, which is fed to Schmitt trigger. This trigger converts sin wave into a square wave, which is in the form of continuous pulses, where one pulse is equal to one positive and one negative value of a single signal cycle.

The first pulse which is generated is given as input to the gate control flip flop turning ON AND gate. The output from this AND gate count decimal value. Similarly, when the second pulse arrives, it disconnects AND gate, and when the third pulse arrives the AND gate turns ON and the corresponding continuous pulses for a precise time interval which is the decimal value is displayed on the counter display.

The frequency of the unknown signal can be calculated by the following formula

F = N / t …………………..(1)

Where

F - Frequency of the unknown signal

N -Number of counts displayed by the counter

t - Time interval between the start-stop of the gate.

Advantages

- Good frequency response
- High sensitivity
- The production cost is low.

Disadvantages

- It does not measure the exact value.

Applications

- The equipment's like radio can be tested
- It can measure parameters like pressure, strength, vibrations, etc.

Oscillators:

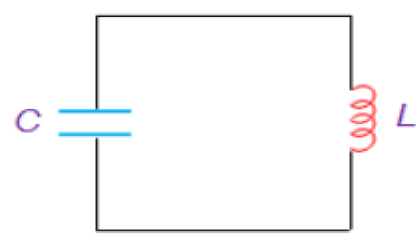
An oscillator is an electronic circuit that produces a periodic signal or creates an ac signal. No external AC input is required to produce oscillations. It converts the input energy from a DC source into an AC output energy of a periodic signal. This periodic signal will be having a specific frequency and amplitude.

It is basically an Amplifier with "Positive Feedback", or regenerative feedback (in-phase) and one of the many problems in electronic circuit design is stopping amplifiers from oscillating while trying to get oscillators to oscillate. Oscillators work because they overcome the losses of their feedback resonator circuit either in the form of a capacitor, inductor or both in the same circuit by applying DC energy at the required frequency into this resonator circuit. They have the following three characteristics.

- Amplification
- Positive Feedback (regeneration)
- A Frequency determine feedback network

Basic principle:

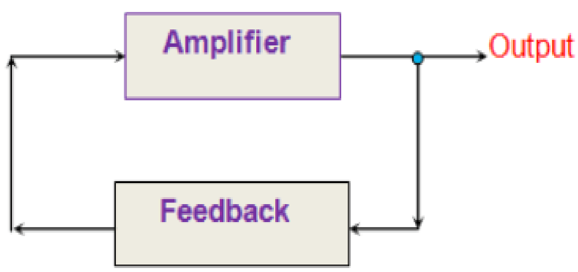
The basic principle behind the working of oscillators can be understood by analyzing the behavior of an LC tank circuit shown in fig. below, which employs an inductor L and a completely pre-charged capacitor C as its components. Here, the capacitor starts to discharge via the inductor, which results in the conversion of its electrical energy into the electromagnetic field, which can be stored in the inductor. Once the capacitor discharges completely, there will be no current flow in the circuit.



LC Tank Circuit

The stored electromagnetic field would have generated a back-emf which results in the flow of current through the circuit in the same direction as that of before. This current flow through the circuit continues until the electromagnetic field collapses which result in the back conversion of electromagnetic energy into electrical form, causing the cycle to repeat. Now the capacitor would have charged with the opposite polarity, due to which one gets an oscillating waveform as the output.

Practically, the oscillators are nothing but the amplifier circuits which are provided with a positive or regenerative feedback wherein a part of the output signal is fed back to the input (fig.). Here the amplifier consists of an amplifying active element which can be a transistor or an Op-Amp and the back-fed in-phase signal is held responsible to sustain the oscillations by making up for the losses in the circuit.



Once the power supply is switched ON, the oscillations will be initiated in the system due to the electronic noise present in it. This noise signal travels around the loop, gets amplified and converges to a single frequency sine wave very quickly. The expression for the closed-loop gain of the oscillator shown in Fig. is given as:

$$G = \frac{A}{1 + A\beta}$$

Where A is the voltage gain of the amplifier and β is the gain of the feedback network.

Here, if $A\beta > 1$, then the oscillations will increase in amplitude (Figure); while if $A\beta < 1$, then the oscillations will be damped. On the other hand, $A\beta = 1$ leads to the oscillations which are of constant amplitude. This indicates that if the feedback loop gain is small, then the oscillation dies-out, while if the gain of the feedback loop is large, then the output will be distorted; and only if the gain of feedback is unity, then the oscillations will be of constant amplitude leading to self-sustained oscillatory circuit.

If $A\beta = 1$, $A_f = \infty$. Thus the gain becomes infinity, i.e., there is output without any input. In another words, the amplifier works as an Oscillator. The condition $A\beta = 1$ is called as Barkhausen Criterion of oscillations. This is a very important factor to be always kept in mind, in the concept of Oscillators.

1. **Sinusoidal Oscillators -** These are known as Harmonic Oscillators and are generally a LC or RC tuned-feedback type that generates a purely sinusoidal waveform which is of constant amplitude and frequency.

2. **Non-Sinusoidal Oscillators -** these are known as Relaxation Oscillators and generate non-sinusoidal waveforms that changes very quickly from one condition of stability to another such as Square-wave, Triangular-wave or Sawtooth-wave type waveforms.

Audio Frequency Oscillator:

It is an electronic device that can generate an audio-frequency alternating voltage waveform. They are typically inexpensive and fairly simple. Generally they are able to generate several waveform types, including sine, square, and triangle waves, as well as pulses of variable length, with easily-adjustable output frequency.

Sine Wave Generator:

A circuit that is used to generate a sine wave is called a sine wave generator. This is one kind of waveform that appears from electricity outlets of home. This waveform can be observed in AC power as well as applicable in acoustics. There are different types of waveforms that are generated by different electronic devices. So each waveform generates different sounds. A sine wave is one kind of signal that is utilized in acoustics.

To design the sine wave generator circuit, there are different types of components are required like an integrated circuit, resistors, capacitors, transistors, etc.

Working Principle:

This is an outstanding tool to generate sine waves using wave drivers otherwise speakers. The frequency range of this generator will range from 1Hz to 800 Hz & the sine wave's amplitude to be changed. Students can notice the nature of quantum for standing wave models when the sine wave generator jumps from one resonant frequency to others. This generator includes in-built memory that permits it to find out the latest and primary frequencies for extra exploration.

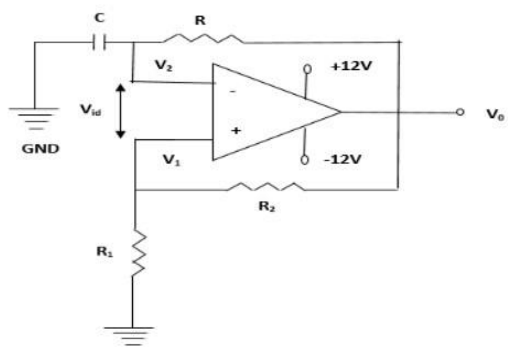
Features:

- Adjust the output frequency using the knobs like Fine & Coarse.
- The sine wave signal voltage can be changed by adjusting the amplitude.
- It has a feature like a smart scan that allows the knobs for changing the frequency easily once turned continuously.
- In this generator device, a plastic case mainly includes a rear rod clamp & angled rubber feet for the options of dynamic mounting.
- An inbuilt clamp is used to place this generator over a standard rod.
- In this generator, the frequency can be displayed digitally with the resolution 0.1 Hz using red color LEDs.
- This generator stores an increment of frequency & will rotate during the range of frequency using the recognized growth for adapted convenience.

Square Wave Generator:

The square wave generator is defined as an oscillator that gives the output without any input. We should give input within zero seconds that means it must be an impulse input. This generator is used in digital signal processing and electronic applications. The square wave generator is also known as Astable Multivibrator or free-running and the frequency of the square wave generator is independent of the output voltage.

To design the square wave generator, we need a capacitor, resistor, operational amplifier, and power supply. The capacitor and resistor are connected to the inverting terminal of the operational amplifier and the resistors R_1 and R_2 are connected to the non-inverting terminal of the operational amplifier. The circuit diagram of the square wave generator using an operational amplifier is shown below



If we force output to switch between the positive saturation voltage and the negative saturation voltage at the output of an operational amplifier we can achieve square wave as an output wave. Ideally without any input applied the output should be zero, it is expressed as

$$V_{out} \text{ (output voltage)} = 0 \text{ V when } V_{in} \text{ (input voltage)} = 0 \text{ V}$$

But practically, we get some non-zero output that is expressed as $V_{0ut} \neq 0$

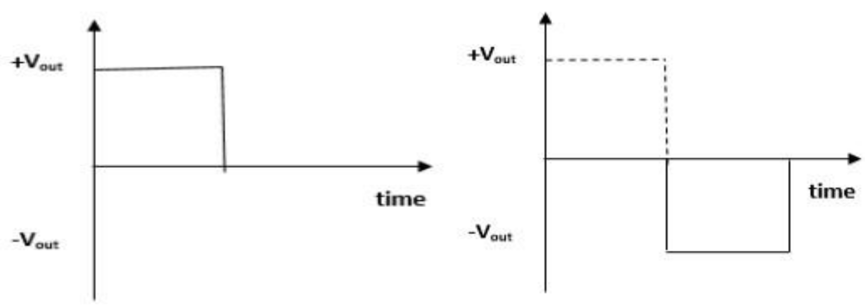


Figure (a) Figure (b)

The capacitor starts charging when a non-zero input is at the inverting terminal. It will charge continuously until its voltage become greater than V_b. As soon as V_c is greater than the V_b ($V_c > V_b$).

The inverting input becomes greater than the non-inverting input and hence op-amp output switches to negative voltage and gets amplified till $(-V_{out})_{max}$.. Thus, we will get the negative half of the square wave as shown in fig (b).

Advantages

- Simple to handle.
- Easy to maintenance.
- Low cost.

Short Questions with Answers:

MEASURING INSTRUMENTS:

1. Give the name of the instrument used to find the thickness of thin objects.
   Screw Gauge
2. Which instrument is used to measure small vertical or horizontal distances with accuracy?
   Travelling Microscope
3. Write the name of the instrument used to study various spectra using prism and grating
   Spectrometer
4. What is the least count of vernier calipers?
   LC=0.01cm
5. What is the least count of screw gauges?
   LC=0.01mm
6. What is PSR?
   Pitch Scale Reading
7. What is MSR?
   Main Scale Reading
8. What is VSC?
   Vernier Scale Coinsidence
9. What is the least count of spectrometer?
   1 minute (or) **1'**
10. Optical instrument that makes distant objects appear magnified is
    Telescope

ELECTRICAL&ELECTRONIC INSTRUMENTS:

1. The instrument, which is used to measure the direct current is

DC Ammeter

2. The instrument, which is used to measure the DC Voltage is
   DC voltmeter
3. An electronic measuring instrument that combines several measurement functions in one unit is
   Multimeter
4. An electromechanical instrument used for detecting and indicating an electric current is
   Galvanometer
5. An instrument that displays the frequency of a periodic electrical signal is
   Frequency meter
6. The best instrument to measure frequency is
   Oscilloscope
7. A test tool used to measure two or more values – volts, current and resistance is
   Digital multimeter
8. AC voltage is measured by using
   AC voltmeter
9. A highly sensitive apparatus for measuring very small charges is
   Spot Reflecting Galvanometer
10. Electrical quantities measured by using
    Electrical instruments

POWER SUPPLY:

1. An electrical device that supplies electrical power to an electrical load is
   Power supply
2. An electronic circuit that converts unregulated AC into DC with the help of rectifier is
   Regulated power supply
3. Give the name of the device which is used as voltage regulator
   Zener Diode
4. In IC regulators , the last two digits of the four digit number indicates
   Output voltage
5. IC – 7800 series used as
   Fixed Positive voltage regulators
6. IC -7900 series used as
   Fixed negative voltage regulators
7. What is the output voltage of IC -7805?

+5 Volts

8. In three terminal regulated power supply, GND indicates
   Earth – connected (or) grounded
9. LM -317 ICs used as
   Adjustable voltage regulators
10. The maximum output voltage of IC -723 is
   40 Volts

TRANSFORMERS

1. A device that is used to step up or step down voltages and currents in an electrical circuit is
   Transformer
2. The device which reduces the output voltage is
   Step down transformer
3. The transformer which increases the output voltage is
   Step up transformer
4. Which wire is commonly used in transformers
   Copper coated with an insulating material
5. The ratio between true power and apparent power is
   Power factor
6. The power dissipated by the circuit is called
   True power
7. Unit of apparent power is
   Volt – Ampere
8. How many coils present in transformers?
   Two
9. Which type of transformer is used in home?
   Step down transformers
10. Which quantity losses occur in transformers?
   Energy

OSCILLATORS

1. Waveform generators are called as
   Oscillators
2. A small part of output may be fed to the input circuit is known as
   Feedback
3. Which feedback principle is used in oscillators
   Positive Feedback

4. Which feedback principle is used in amplifiers

   Negative feedback
5. When the feedback voltage is in phase with the input voltage, then the feedback is called

   Positive feedback
6. Give one example for sine wave generator

   Hartley Oscillator
7. The generator used in digital signal processing is

   Square wave generator
8. An electronic LC used in oscillators is called

   Tank circuit
9. An electronic oscillator which generates alternating waveforms in the range of audio frequency is

   Audio frequency oscillator
10. Audio frequency range is

    20Hz to 20KHz