**Summer 2016– EXAMINATIONS**

Subject Code: **17317** **Model Answer**

## Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in the answer scheme.

2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.

3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills.

4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.

5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.

6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.

7) For programming language papers, credit may be given to any other program based on equivalent concept.

**EIM Solution**

**Qus.1 A) Attempt any six of the following: 12**

a) **Define sensitivity and reproducibility.**

**ANS:- (Each Definition- 1 mks)**

**Sensitivity:** The ratio of change in output of an instrument to the change in input is known as sensitivity. Sensitivity = Change in output/ Change in input.

**Reproducibility:** It is defined as the degree of closeness by which a given value can be repeatedly measured.The reproducibility is specified for a period of time.Perfect reproducibility is signifies that the given readings that are taken for an input, do not vary with time.

b) **Enlist the specifications of analog DC voltmeter.**

**ANS:- (Any 4- 2 mks)**

1) **Voltage range:** 1mV to 300V F.S. 12 ranges
2) **Frequency Range:** 10Hz to 10MHz
3) **Input impedance:** 10mΩ on all ranges.
4) **Accuracy:** ±1% reading ,3mV to 300V range

c) **State how DMM can be used to check diode and transistor.**

**ANS:DMM for diode testing ( 1 mks)**

Digital multimeters can test diodes using one of two methods: Diode test mode and resistance mode

( Explain any one- 1 mks)

**Diode Test mode**: almost always the best approach- A diode is best tested by measuring the voltage drop across the diode when it is forward-biased. A forward-biased diode acts as a closed switch, permitting current to flow. A multimeter's Diode Test mode produces a small voltage between test leads. The multimeter then displays the voltage drop when the test leads are connected across a diode when forward-biased.

DMM for transistor testing- ( 1 mks)

Assuming you know if the transistor is NPN or PNP, and assuming you know where B, C, and E are, then just test the B-C junction and the B-E junction as if they were standard diodes. if one of those junctions is a "bad diode", then the transistor is bad. Also, check the resistance from C to E using a higher Ohms scale (say, the 2 Meg scale). Be sure your fingers don't touch the metal test points or you will just measure your skin resistance. If the transistor is good, you should get an open-circuit reading from collector to emitter.

**d) Define RMS value and peak to peak value.**

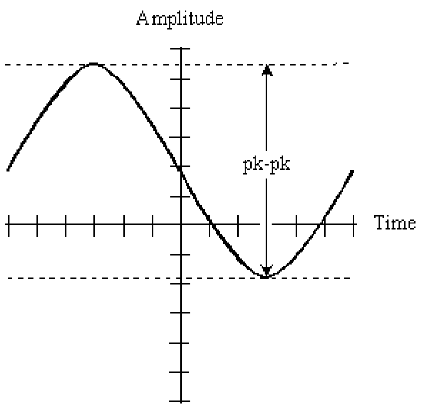
**ANS:- ( Each definition – 1 mks)**

RMS value: (Root mean square value ) the r.m.s. value is given by measuring the current or voltage at equal intervals of time for one complete cycle of the waveform. Each quantity is squared . finally are the terminals are summed and squared root is found. This will give the RMS value.

e.g. $Vrms = \sqrt{\frac{V1^2+V2^2+V3^2+\cdots Vn^2}{n}}$

Vrms = 0.707 Vmax

**Peak to Peak value**: Peak-to-peak (pk-pk) is the difference between the maximum positive and the maximum negative amplitudes of a waveform, as shown below. If there is no direct current ( DC ) component in an alternating current ( AC ) wave, then the pk-pk amplitude is twice the peak amplitude.




**e) List the four applications of CRO.**

**ANS:- ( Any four – 2 mks)**

1. It is used in laboratory for measurement of AC/DC voltage, current, frequency, phase and study nature of waveform.
2. It is used in TV receiver for creation of images.
3. It is used in radar receiver for giving visual indication of target such as aeroplane, ship etc.

4. It is used to test AF circuit for different distortion.
5. It is used to check faulty component.
6. It is used to check signals at radio and TV receiver.
7. It is used to check B-H curve of different ferromagnetic material.
8. It is used in medical equipment such as ECG, patient monitor.
9. It is used to check modulation percentage of modulated wave.
10. It is also used to check radiation pattern generated by antenna.

**f) List out any four features of logic analyzer.**

**ANS:- ( Any 4 features- 4 mks)**

1) The types or modes of display in logic analyzers are of two types:
   1. Logic Timing 2. Logic state

2) Captures and displays multiple signals from a digital system or digital circuit.

3) Convert the captured data into timing diagrams, protocol decodes, state machine traces etc.
4) The mainframe/chassis contains the display, controls, control computer, and multiple slots into which the actual data-capturing hardware is installed
5) For the very high end modular logic analyzers, the user often must provide their own host PC or purchase an embedded controller compatible with the system
6) they are often used for general purpose debugging by cost conscious users
7) The hardware connects to a computer through a USB or Ethernet connection and relays the captured signals to the software on the computer
8) These devices are typically much smaller and less expensive because they make use of a PC's existing keyboard, display and CPU.
9) Compatible with TTL, CMOS.

**g) State the functions of delay line.**

**ANS:- ( Proper function- 2 mks)**

The delay line is used in CRO to delay the signal for some time in the vertical sections. As horizontal channel consists of trigger circuit and time based generator. this causes more time to reach signal to horizontal plates than vertical plates. For synchronization of reaching input signal at same time to both the plates in CRT.

**h) Define wave analyzer and state its need.**

**ANS:- ( Definition- 1 mks, need – 1 mks)**

**Wave analyzer:-**Wave analyzer is an instrument which is used to measure the magnitude of the various harmonics of a complex waveform. It is an instrument that is designed to measure the relative amplitudes of single frequency components in a complex or distorted waveform.

**Wave analyzer need:** Signal analysis of both random and periodic signal in the frequency domain is used extensively in electronic and telecommunication. The frequency stability and special purity of signal sources can be measured by the use of these signal analyzers. These signal analyzer can be used along with a frequency generator or a source of white or pseudo-random noise to measure the frequency response of amplifiers, filters or other networks. The operational characteristics of a transreceiver and communication system are determine by measuring various parameters, such as spectral purity of the carrier wave, spectral power distribution of the amplitude or frequency modulated wave, signal distortion and the system signal to noise ratio.

B**) Attempt any two of the following: 08**

**a) State the reason for ammeter never connected in shunt across a source of EMF.**

**ANS: ( Proper relevant answer- 4 mks)**

The following precautions should be taken while using an ammeter:

1. While connecting an ammeter across the emf source always a series resistance should be used. This is necessary to limit the current passing through the meter movement may be damaged. This is because the meter is having a small internal resistance. So it may draw very high current from the emf source.
2. The polarity of the meter should be first observed and then it should be connected accordingly. The reverse polarity may damage the pointer of meter.

**b) State how frequency and phase can be measured using Lissajous pattern.**

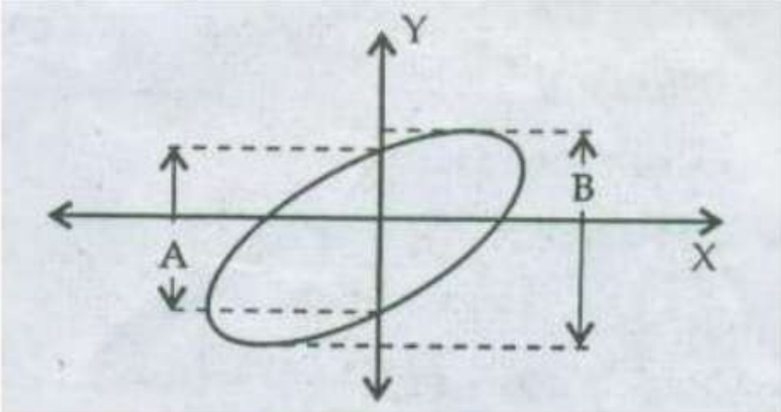
**ANS: Phase measurement of Lissajous figures : 2 mks**

The phase measurement can be done by using Lissajous figures.

The CRO is set to operate in the X- Y mode, then the display obtained on the screen of a CRO is called Lissajous pattern, when two sine waves of the same frequency are applied to the CRO.

( One vertical and one horizontal deflection plates). Depending on the phase shift between the two signals, the shape of the Lissajous pattern will go on changing.The phase shift is given by,

Ɵ = sin-1 (A/B)




A. The Lissajous pattern will be an ellipse if the sine waves of equal frequency but phase shift between 00 and 900 are applied to the two channels of CRO. The Lissajous pattern will be as shown below-

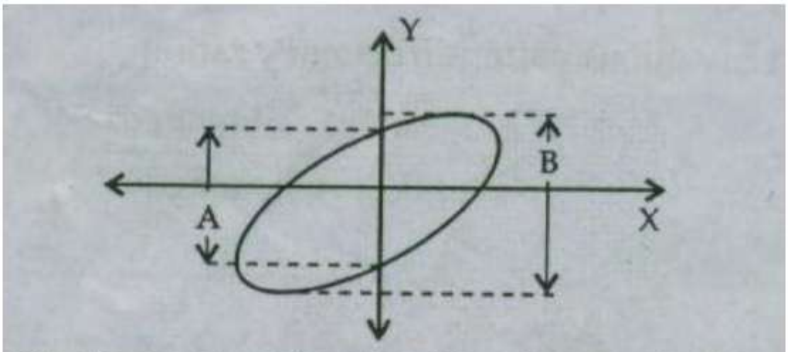
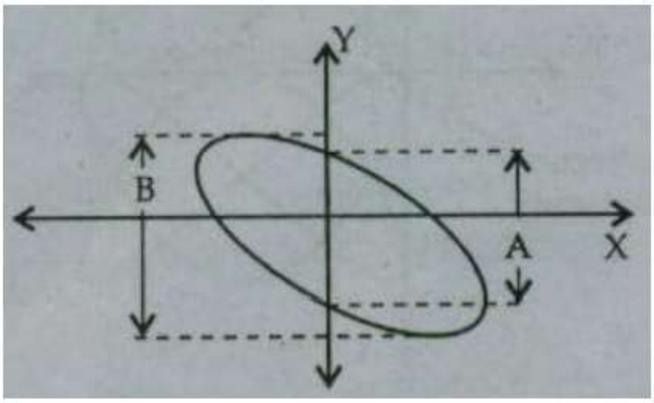
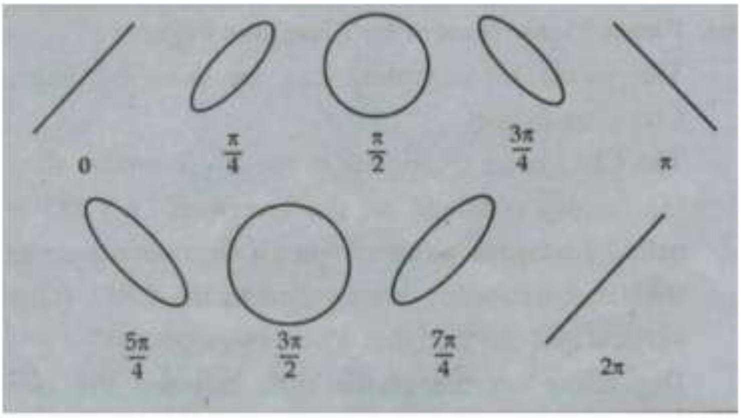



Fig. Lissajous pattern for ellipse for $0^\circ < \theta < 90^\circ$

B. For the phase difference above 900 and less than 1800, the ellipse appears as shown

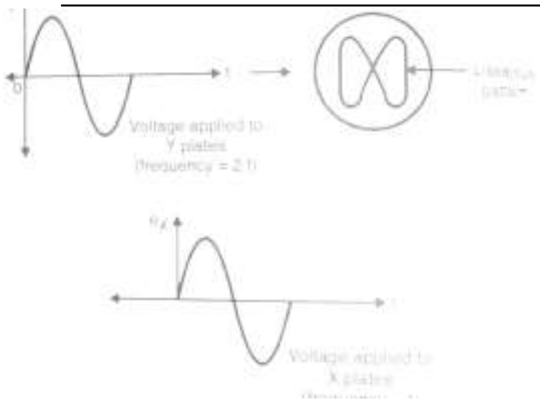



C. Different Lissajous figure for phase difference 00, 450, 900, 1350, 1800, 2250, 2700, 3150, 3600 are shown below respectively




**Frequency measurement by Lissajous figures: (2 M)**

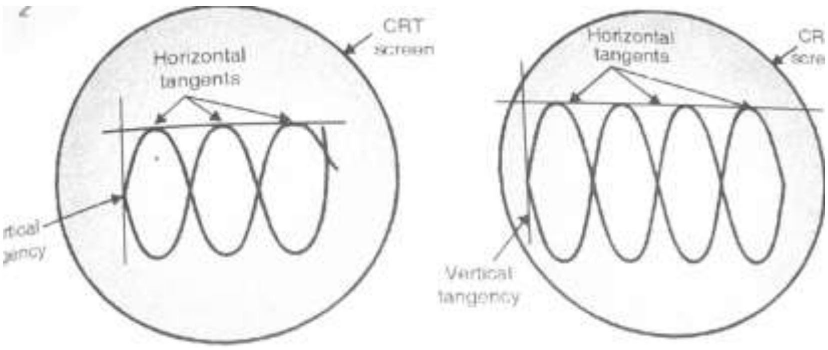
Apart from phase measurement, the lissajous patterns can also be used for measurement of unknown frequency.Initially the unknown frequency signal is connected to the vertical deflection plates of the CRO.Now, switch of the internal sweep generator to the horizontal deflecting system. A standard source of frequency applied to the horizontal deflection plates.The frequency of the standard source is adjusted now, until a circular or elliptical pattern appears on the CRT screen.When such a pattern is observed on the screen, it indicates that the two frequencies are equal.Practically, it is not possible to adjust the standard frequency exactly equal to unknown frequency. Hence, the standard frequency is adjusted to be a multiple or sub multiple of the unknown frequency.The lissajous pattern appears stationary.Consider two sine waves are applied to Y plate and X plate of the CRT. The frequency applied to Y plate is twice than that applied to the X plates. The lissajous pattern is shown in figure.



The frequency ratio is given by,

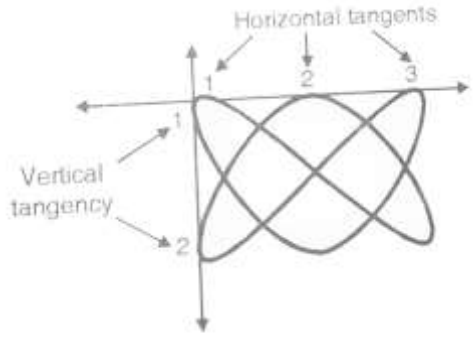
fy/fx = number of horizontal tangents/ number of vertical tangents

As seen in figure the CRT spot travels two complete cycles in the vertical direction against one in horizontal direction. This method is also called spot will method for frequency measurement. For different frequency ratios, different Lissajous pattern are obtained. Figure shows the Lissajous pattern for the frequency ratio 3 : 1 and 4 : 1.




For a non integral ratio, the pattern obtained is shown in figure.

Frequency ratio = number of horizontal tangents/number of vertical tangents = 3/2




**c) Explain primary standard and secondary standard.**

**ANS:**

**Primary standards:- ( 2 mks)**

- They are highly accurate and can be used as ultimate reference standards.
- These standards are maintained by the NBSC (National Bureau of Standards) in different parts of the world.
- They are not available outside the national laboratories.
- The main function of the primary standards is the verification and the calibration of secondary standards.

**Secondary standards: ( 2 mks)**

- Secondary standards are the basic reference standards used in the laboratories.
- These are the highest level of standards that a manufacturer has.
- Each industry has its own standards. The secondary standards is responsible for the calibration of these standards.
- The secondary standards are periodically sent to the national standard laboratories for calibration and comparison against primary standards.

**Qus. 2) Attempt any four of the following: 16**

**a) Describe Gross error, systematic error and random error.**

**ANS:** ( 4 mks can be given as per the proper explanation for the three definitions0

1. **Gross Error -** These errors are mainly human mistakes in reading instruments and recording and calculating measurement results. As human beings are involved, some gross errors will definitely be committed. Although complete elimination of gross error is impossible, one should try to anticipate and correct them. Some gross error is easily detected while others may be very difficult to detect. These errors cannot be mathematically

treated. However can be avoided by great care should be taken in reading and recording the data and two, three or more readings should be taken for quantity under measurement.

2. **Systematic Error** – These types of error are divided into three categories - Instrumental Errors , Environmental Error and Observational Error .

Instrumental error is due to inherent shortcomings in the instrument, due to misuse of the instrument and due to loading effects of instrument.

Environmental errors are due to conditions external to the measuring device including conditions in the area surrounding the instrument. These may be effect of temperature, pressure, humidity, dust, vibrations or of external magnetic or electrostatic fields.

Observational error is nothing but parallax error. As the pointer of analog measuring instruments rests slightly above the surface of scale it causes parallax error. To minimize parallax error meters are provided with mirror.

3. **Random Error** – These errors are due to unknown causes which are not determinable. Such errors those remain after gross and systematic errors have been substantially reduced. Random errors are statistical fluctuations (in either direction) in the measured data due to the precision limitations of the measurement device. Random errors usually result from the experimenter's inability to take the same measurement in exactly the same way to get exact the same number.

b) **Design multirange DC ammeter for $R_m$ = 100Ω, $I_m$ =1mA and required current ranges are 0-20mA, 0-100mA, 0-200mA.**

**ANS:( proper step by step design – 4 mks)**

Here $R_m$ = 100Ω and $I_m$ = $T_{fsd}$ = 1mA

Here three ranges are required. That means three shunt resistor should be used.

**For the range 0-20mA:**

We have, $Rsh1 = \frac{Rm}{m-1}$

m = Multiplying power

$= \frac{I}{Im} = \frac{20}{1} = 20$

$$\therefore Rsh1 = \frac{100}{(20-1)}$$

$$= 5 \cdot 26\Omega$$

**For the range 0-100mA:**

We have, $Rsh2 = \frac{Rm}{m-1}$

Here, $m = \frac{I}{Im} = \frac{100}{1} = 100$

$$\therefore Rsh2 = \frac{100}{(100-1)} = 1.01\Omega$$

**For the range 0-200mA:**

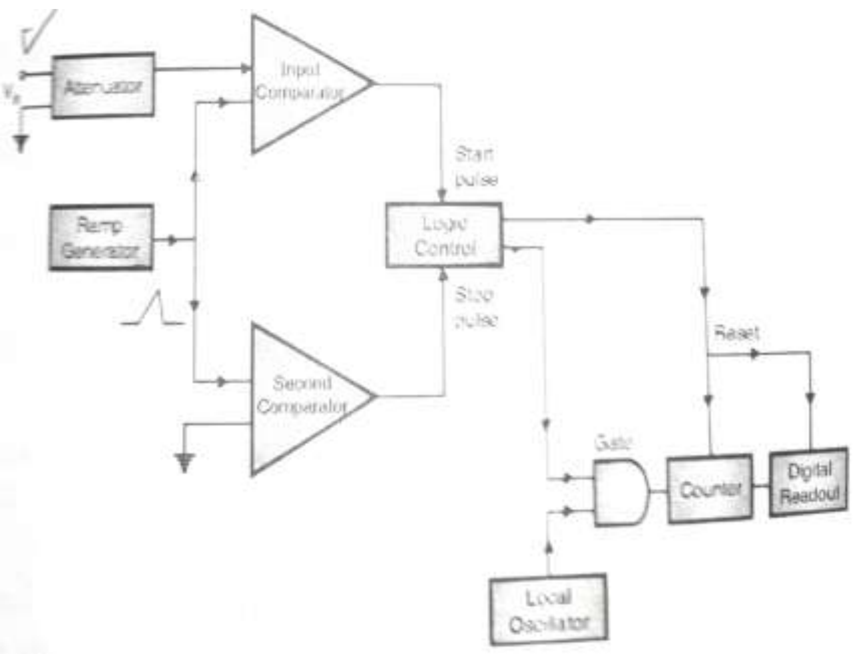
We have, $Rsh3 = \frac{Rm}{m-1}$

Here, $m = \frac{I}{Im} = \frac{200}{1} = 200$

$$\therefore Rsh3 = \frac{100}{(200-1)} = 0.5\Omega$$

**c) Explain the working of linear ramp type DVM.**

**ANS: ( Diagram- 2 mks, explanation- 2 mks)**

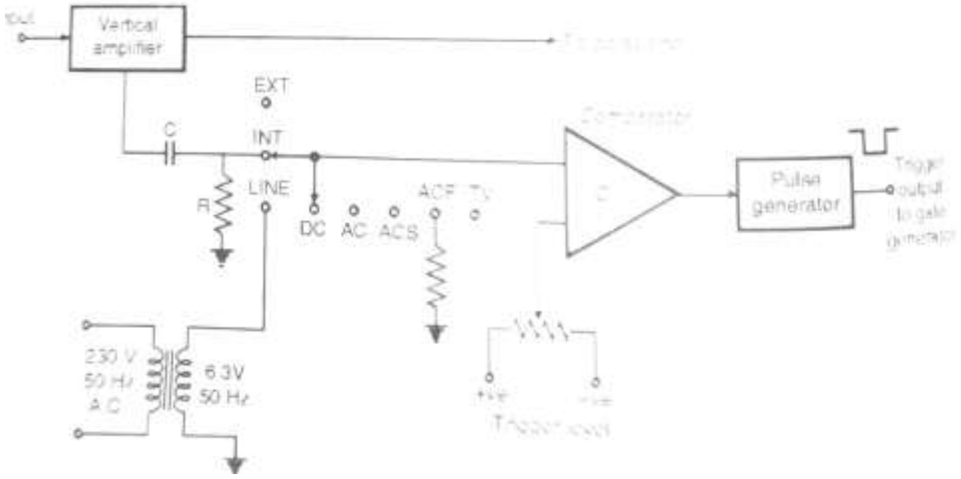



**Working:**

- Unknown voltage to be measured is applied to the input side.
- Initially the logic circuit sends the reset signal to the counter and digital readout.
- Before the starting of measurement the counter and digital readout are resetted.
- The ramp generator, generates the ramp wave. This ramp may be positive going or negative going. Consider a positive going ramp. This ramp signal is applied to the both of the comparators.
- Here each comparator is design in such a way that when both the input signals of a comparators are equal then the comparator changes its states. That means when both input signals are equal then the output voltage swing of a comparator takes place.
- In this system, one comparator is used to open the gate while other comparator is used to close the gate.
- In this case we have considered a positive going ramp pulse.
- The reference voltage for the second comparator is the ground level.
- When the ramp signal crosses the zero voltage then both inputs of seconds comparators becoms equal.
- So the output stage of this comparator changes. This signal is sent to the logic control.
- The logic control circuit gives the signal to the logic gate. This causes the opening of gate.
- Once the gate is opened; the counter starts counting the number of pulses. These number of pulses are provided by the local oscillator.
- The number of pulses generated by the local oscillator in a particular time interval depends on the frequency of local oscillator.
- The ramp signal is applied to both comparators. One input terminal of first comparator is connected to the input unknown voltage.
- When the ramp voltage becomes equal to input unknown voltage; then both input signals of first comparators are equal. So the output stage of this comparator are changes.
- Now the signal from logic control circuit is used to close the gate.
- Once the gate is closed, the number of pulses will stop passing to counter. So the counter will stop the counting operation.
- During the time interval between opening and closing the gate; a definite number of pulses will be counted by the counter.
- This number is displayed by the digital readout.

**d) Draw the block diagram of horizontal deflection system. State the roll of trigger circuit and time base generator in CRO.**

**ANS: ( Diagram- 2 mks, explanation- 2 mks)**




**The roll of trigger circuit and time base generator in CRO:**

- The trigger circuit can be activated by signals of a variety of shapes and amplitudes, which are converted to trigger pulses for the sweep operation.
- If the trigger level is too low, the trigger generator will not function. If the trigger level is too high, the UJT may conduct for a long period and leading edge of the input signal is lost.
- The circuit which is responsible for starting the sweep at desired location is called as trigger generator figure shows trigger generator circuit.
- The trigger selection is a 3 position switch, internal, external and line. The trigger coupling has different positions AC, DC, ACS, ACF and TV.
- The comparator circuit C produces a change in its output, whenever the trigger input exceeds the threshold level.
- The pulse generator following the comparator will produce negative pulses whenever the comparator output crosses its threshold level.
- It also triggers the sweep generator to start the next sweep.
- The functions of the trigger sources are :

  **INT(Internal):** Its function is to provide a replica of the input signal that is applied to the vertical amplifier.

  **EXT(External):** An external input is used in this case. The sweep will begin at the time determined by the external conditions. Whenever the input waveform is small in magnitude, this kind of triggering is preferred.

  **LINE:** It is achieved from the frequency of the power line i.e. 50Hz. Whenever the waveform has a fixed time relationship with the line frequency, this mode is preferred.

- The different types of triggering coupling are :

  **AC coupling:** It is used to give stable display of signal on the screen.

  **DC coupling:** It is used to give stable display of the signal on the screen.

  **ACS:** It indicates AC slow. It indicates AC slow. It gives low frequency triggering capability in the presence of high frequency signals.

  **ACF:** It indicates AC fast. It gives high frequency triggering capability in presence of low frequency signals. The main objective of ACF is to reject the line frequency and hum mixed with the triggering signal.

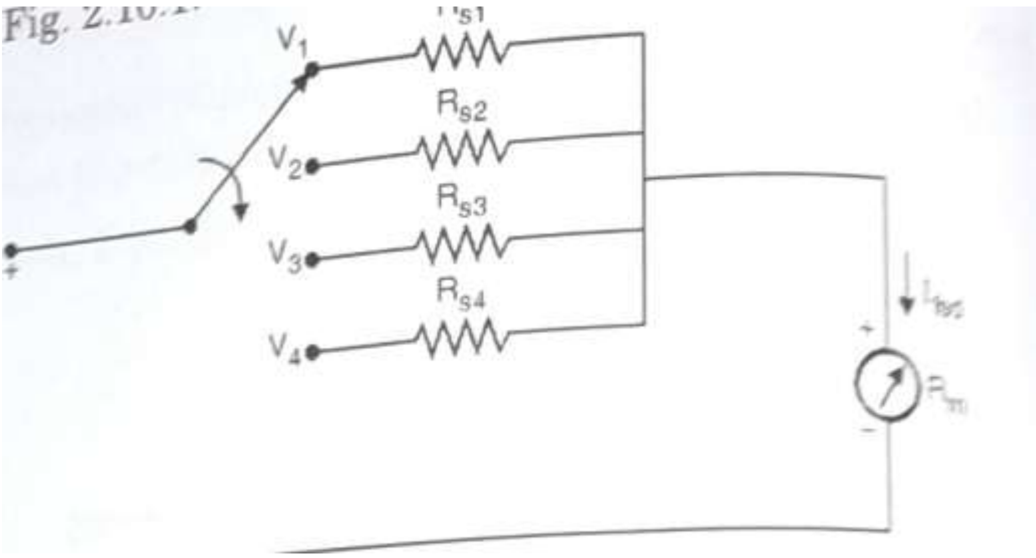
  **TV:** It allows us to synchronize to the horizontal / vertical frequencies used in the television sweep system.

- The triggering level control adjusts the threshold level of the comparator which will select the input voltage level.
- The trigger slope can be positive or negative.

**e) Draw the circuit of multirange AC voltmeter and explain its working.**

**ANS: ( Circuit – 2 mks, explanation- 2 mks)**

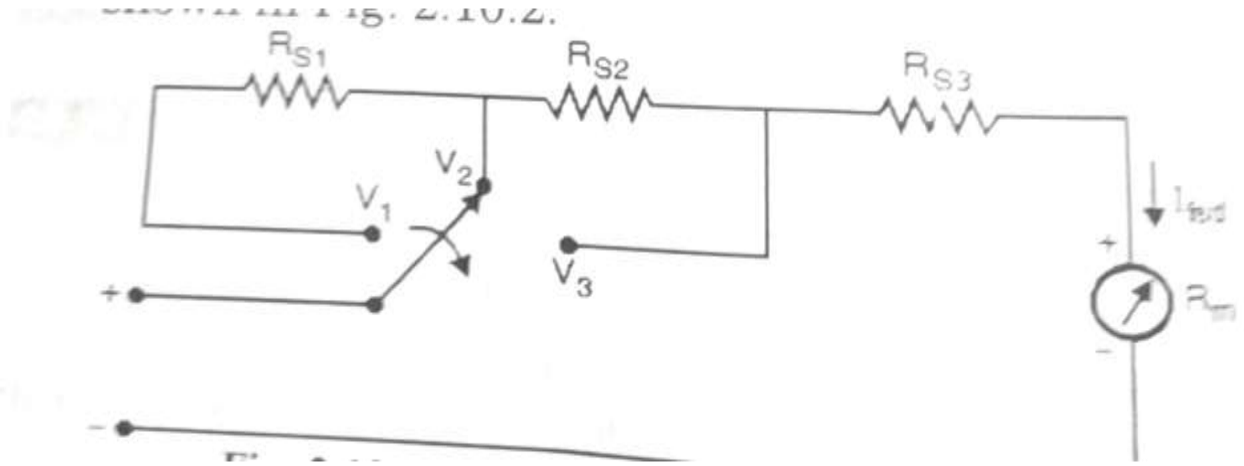
- As the name indicates the multirange voltmeter gives the different voltage ranges.
- To convert the basic dc voltmeter into multitrange volt meter, the number of series resistances (multipliers) are used.
- This multipliers may be connected in shunt or in series.
- The multipliers connected in shunt are as shown in figure.



- $R_{S1}$, $R_{S2}$, $R_{S3}$,$R_{S4}$ are four series multipliers.
- They are connected in shunt. To select a proper multiplier, a four way switch is used.
- Thus the four different voltage ranges are obtained.
- The equations for series resistors may be written as,

RS1 = $V_1/I_{fsd} – R_m$ , $R_{S2} = V_2/I_{fsd} - R_m$

- In practical multirange voltmeter, the multipliers are connected in series this arrangements are as shown in figure.




- Three multipliers namely $R_{S1}$, $R_{S2}$, and $R_{S3}$ are connected in series.
- A three way switch is used to select the proper multiplier.
- This type of series connection is advantageous over shunt type because in this case $R_{S1}$ and $R_{S2}$ are standard resistances.
- They are easily available in the market.
- Only the multiplier RS3 is special type of resistor. It is manufacture according to the circuit requirements.
- When the switch is at position $V_1$, $R_{S1} + R_{S2} + R_{S3}$ acts as multiplier resistance.
- When the switch is at position $V_2$ , $R_{S2} + R_{S3}$acts as multiplier resistance.
- V3 is the lowest voltage range, while $V_1$ is the maximum voltage range.
- The multiplier resistances can be calculated as,

In position $V_3$, the multiplier is $R_{S3}$ only if the total resistance of the circuit is $R_T$.

$R_T = V_3 / I_{fsd}$

$R_{S3} = R_T-R_m$

In position $V_2$, the multiplier is $R_{S2} + R_{S3}$

$R_T = V_3 / I_{fsd}$

$R_{S2} + R_{S3} = R_T - R_m$

$R_{S2} = R_T - (R_m + R_{S3})$

In position $V_1$, the multiplier is $R_{S1} + R_{S2} + R_{S3}$

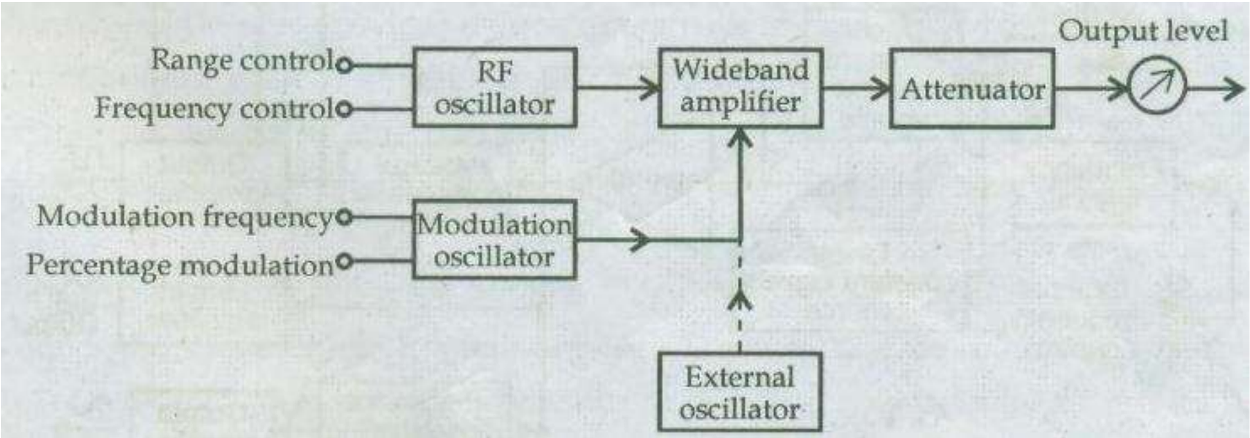
$R_T = V_1 / I_{fsd}$

$R_{S1} + R_{S2} + R_{S3} = R_T - R_m$

$R_{S1} = R_T - (R_m + R_{S2} + R_{S3})$

**f) Explain the working of standard RF signal generator and explain it.**

**ANS:- ( Diagram- 2 mks, explanation-2 mks)**




The standard signal generator produces controllable voltage and frequency. The output signal from a conventional standard signal generator is either frequency modulated or amplitude modulated. It is commonly used in radio receivers and transmitters. It is basically an RF signal generator.

**Principle of operation :** The output from the generator is either amplitude modulated or frequency modulated. The frequency modulation is done by using a carrier from stable RF oscillator. Amplitude modulation is done using internal sine wave oscillator. The modulation is done by a wide band amplifier. Depending on the modulation and setting of attenuator, output meter an indication of the signal.

**Operation:** Figure shows the block diagram of conventional standard signal generator.

The RF oscillator is formed by an LC tank circuit. It generates a stable carrier frequency over any frequency range. The oscillator is an LC tank circuit, so the frequency stability is limited. The frequency range is selected y connecting a switch to particular capacitor.The amplitude modulation is provided by an internal sine wave generated. It may also provided by an external source.The modulation is done in a wide band amplifier. For modulation sine, square, triangular wave or pulse may be used. The output of wideband amplifier is connected to attenuator.

The required range of attenuation is selected and level of output signal can be controlled. The output meter is used to give an indication of output signal.

**Qus. 3) Attempt any four of the following:**

**a) Draw constructional diagram of PMMC meter and explain working principle.**

**ANS:( Construction- 2 mks, working- 2 mks)**

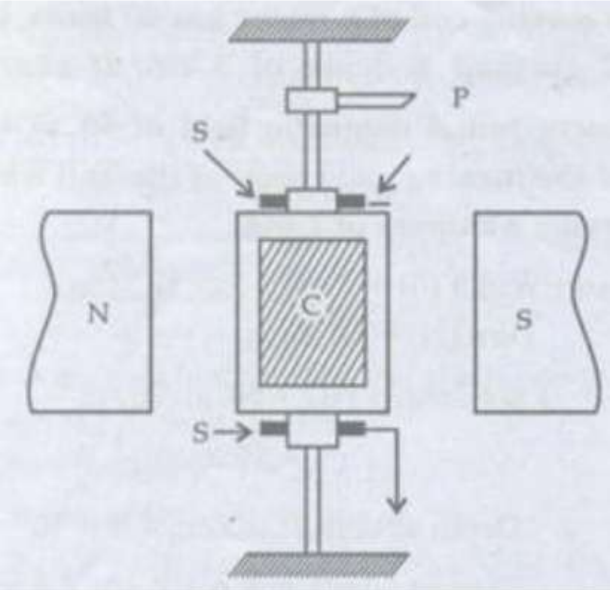



Fig: PMMC Instrument

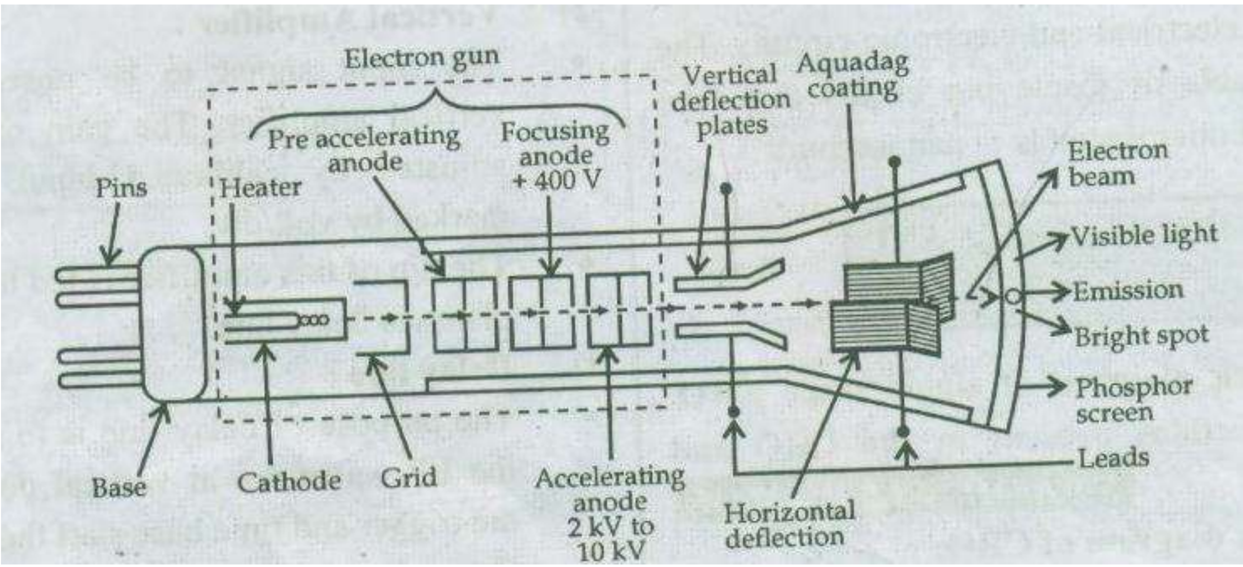
**Working:**

When current passes through the coil a deflecting torque is produced. This deflecting torque is produced due to interaction between magnetic field produced by permanent magnet and magnetic field produced by moving coil.

Due to this torque the coil deflects and this deflection is proportional to the current flowing through the coil. The pointer attached to the coil indicated the magnitude of quantity being measured. The another torque is developed by the hair spring known as controlling torque. This torque helps to stabilize the pointer. The pointer becomes stable at equilibrium; this is possible only when the controlling torque becomes equal to the deflecting torque.

**b) Draw labeled diagram of CRT and explain working of CRT.**

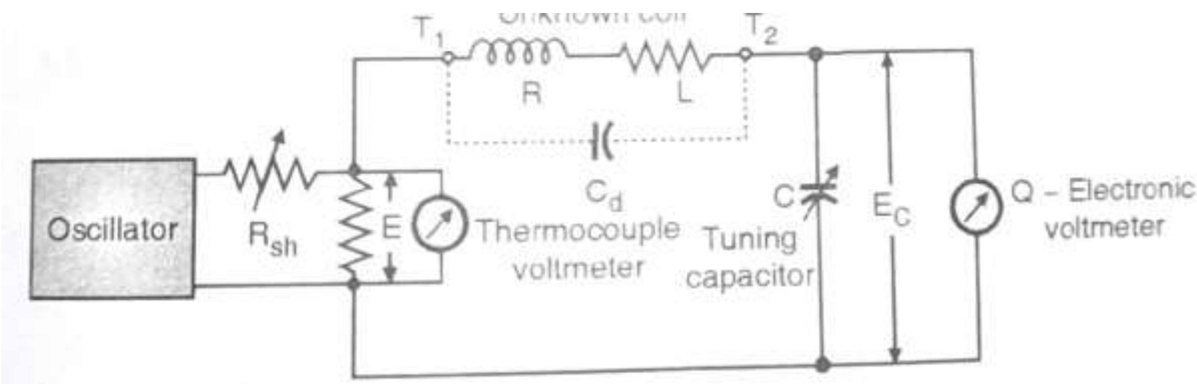
**ANS: ( Block diagram- 2 mks,explanation- 2 mks)**




It consists of an electron gun. The electron gun produces an electron beam. This beam is narrow and is allowed to pass down the tube, and to fall on the screen. The screen is formed by the flat end of glass tube which is coated with the fluorescent material. The point at which the electron beam strikes the screen, a spot is formed. The electron beam passes through two pairs of electrostatic deflection plates i.e. horizontal and vertical deflecting plates. The voltages which are applied to these plates deflect the beam. Horizontal deflecting plates move the spot ion horizontal direction and vertical deflecting plates move the spot on the screen in vertical direction. These two movements i.e. vertical and horizontal are independent of each other and thus the beam may be displayed anywhere on the screen.

**c) Draw diagram of LCR-Q meter and how different parameters are measured using it.**

**ANS: ( Diagram-2 mks, measurement of any 2 parameters- 1mks each)**




1. **Measurement of Q:**
   The voltmeter is calibrated directly in terms of Q.

However there is an error.

The measured value of Q is the Q of whole circuit and not of the coil.

There are errors caused on account of the shunt resistance and due to distributed capacitance.

Correction for shunt resistance:

$$Q = \frac{\omega L}{R}$$

$$Qmesured = \frac{\omega L}{R + Rsh}$$

$$\frac{Qactual}{Qmeasured} = \frac{\omega L/_{R}}{\omega L/_{R + Rsh}} = \frac{R + Rsh}{R}$$

$$\frac{Qactual}{Qmeasured} = 1 + \frac{Rsh}{R}$$

$$Qactual = Qmeasured = \left[1 + \frac{Rsh}{R}\right]$$

To reduce the error $R_{Sh}$ should be as small as possible.

The distributed capacitance or self capacitance of measuring circuit modifies the true value of Q.

The measured value of Q is less than the true value by a factor that depends on the value of distributed (self) capacitance and the tuning capacitor.

$$Qactual = Qmeasured = \left[1 + \frac{Cd}{C}\right]$$

$C_d$ = distributed or self capacitance.

C = tuning capacitance.

2. **Measurement of inductance:**

The value of f and c are known. So inductance can be found

$$f = \frac{1}{2\pi\sqrt{LC}}$$

$$\therefore L = \frac{1}{4\pi^2 f^2 C}$$

f = Resonant frequency.

3. **Measurement of effective resistance:**

The value of effective resistance may be computed from the relation $R = {}^{\omega L}/_{Qactual}$

4. **Measurement of self capacitance:** The self capacitance is measured by making two measurements at different frequencies.
   The capacitor is set to a high value of circuit is resonated by adjustment of the oscillator frequency.

   The resonance is indicated by maximum deflection on the Q meter.

   Let the tuning capacitor be C1 and that of frequency f1 under this conditions.

   Therefore,

$$f1 = \frac{1}{2\pi\sqrt{L(C1 + Cd)}}$$

   The frequency is now increased to twice its initial value and circuit is resonated, with the help of tuning capacitor. Let $C_2$ be value of tuning capacitor and frequency $f_2$ .

$$\therefore f2 = \frac{1}{2\pi\sqrt{L(C2 + Cd)}}$$

$$f2 = 2f1$$

$$\frac{1}{2\pi\sqrt{L(C2 + Cd)}} = 2 \times \frac{1}{2\pi\sqrt{L(C1 + Cd)}}$$

$$\frac{1}{C2 + Cd} = \frac{4}{C1 + Cd}$$

$$C1 + Cd = 4C2 + 4Cd$$

$$\therefore C1 - 4C2 = 3Cd$$

$$Cd = \frac{C1 - 4C2}{3}$$

5. **Measurement of bandwidth:**

Bandwidth can be determine from Q value.

$$B.W. = \frac{f}{Q}$$

f = resonant frequency.

6. **Measurement of capacitance:**
   For measurement of capacitance a dummy coil is connected across terminal T1 and T2 as shown in figure .

   The circuit is resonated by varying the value of the tuning capacitor. Let this value be C1.

   The capacitor under test is connected across the tuning capacitor. Let this value be C2.

$$\therefore value\ of\ capacitance\ under\ test\ CT = C1 - C2$$

d) **Explain different dynamic characteristics of instrument**.

ANS: ( Any 4 explanation- 1mks each)

Dynamic characteristics of instruments are:

**1. Speed of response:** The rapidity with which instrument responds to make changes in the measured quantity is called as speed of response.

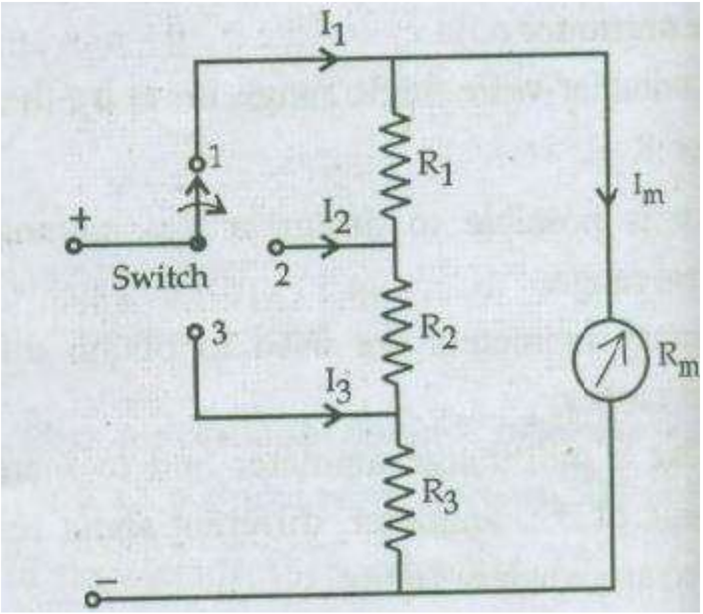
**2. Fidelity:** The degree to which instrument indicates the change in measured variable without dynamic error is called as fidelity.

**3. Lag:** The retardation on delay in the response of an instrument to make the change in measure quantity is known as lag.

**4. Dynamic error:** The difference between the true value of a quantity changing with time and the value indicated by the instrument if no static error is assumed is called as dynamic error.

**e) Explain the working of Ayrton Shunt type DC ammeter with the help of diagram.**

**ANS: ( Diagram- 2 mks, explanation- 2 mks)**




In this shunt, different resistors are connected in series as shown in circuit. A variable switch is used to connect supply to terminal 1,2 &3. Let the current passing through meter is Im and I1, I2 , I3 are different ranges. The equation for different position of switch is as follows.

**Position 1=** When switch (s) is at position 1, the resistors R1 , R2 and R3 is in series. This series combination of resistor is in parallel with meter resistance Rm.

Therefore, $(I_1 - I_m)(R_1 + R_2 + R_3) = I_m . R_m$ ------------------------------- (1)

**Position 2=** When switch (s) is at position 2, the combination of R2 and R3 parallel with combination of R1 and Rm.

Therefore, $(I_2 - I_m)(R_2 + R_3) = I_m(R_1 + R_m)$ ---------------------------- (2)

**Position 3=** When switch (s) is at position 3, the resistance R3 is in parallel with combination of R1 , R2 and Rm.

$(I_3 - I_m) R_3 = = I_m(R_1 + R_2 + R_m)$ ---------------------------- (3)

By solving equation 1,2, and 3 the values of unknown shunt resistors can be calculated.

**f) Draw the block diagram of pulse generator and explain its operation.**

**ANS:( Block diagram- 2 mks, explanation- 2 mks)**

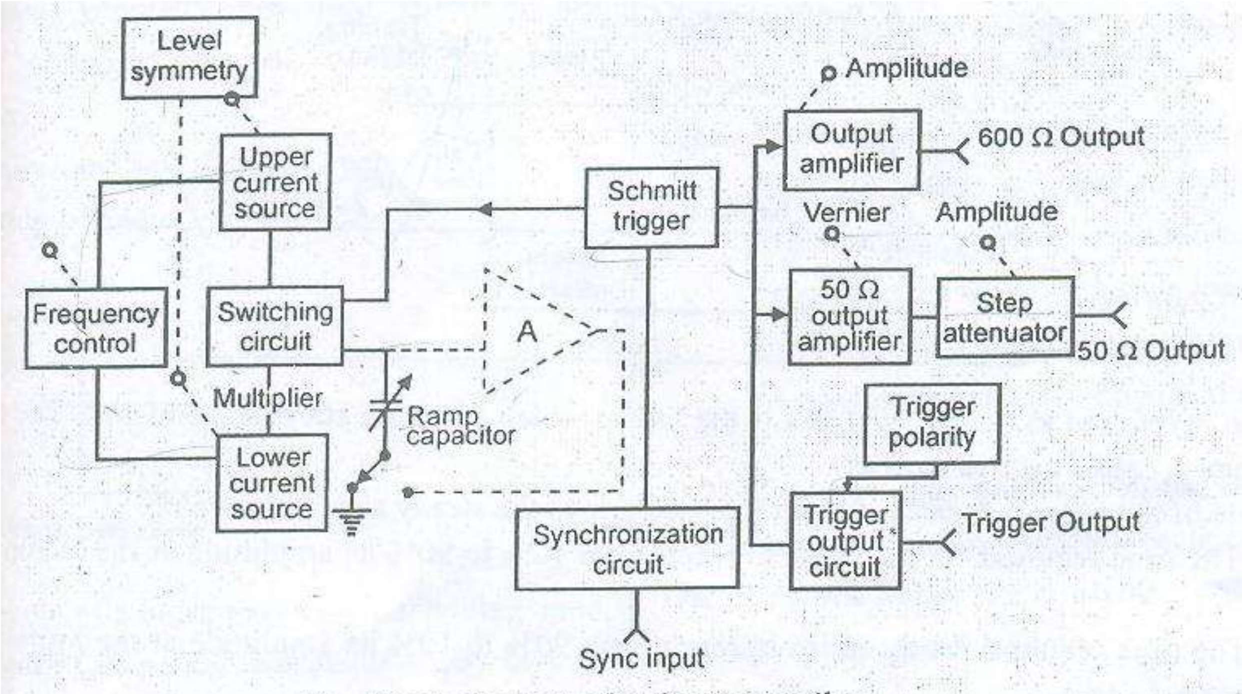


Fig. Block diagram of pulse generator

Explanation**-** Figure shows the block diagram of pulse generator. The circuit consists of two current sources, a ramp capacitor and schematic trigger circuit as well as current switching circuit. The two current sources provide a constant current to a ramp capacitor, so that the capacitor can be charged and discharged.

The ratio of the charging current and discharging current is determined by setting the symmetry control i.e. the symmetry control determine the duty cycle of the output waveform. In the current source and appropriate control voltage is applied to control the current in transistors which control the frequency i.e. the sum of the two current.The multiplier switch provides decade swathing control output frequency and frequency dial provides continues vernier control of the output frequency. The upper current source provides a constant current to the ramp capacitor. This will charge the capacitor at a constant rate. The voltage across the ramp capacitor linearly increases. When the positive ramp reaches maximum upper limit set by the circuit components, the Schmitt trigger changes its state. The trigger circuit output become negative. The trigger circuit negative output changes the condition of the current control switch this make the capacitor to slowly discharge linearly. When the discharge ramp reaches the lower limit set by the circuit components the schematic trigger comes back to its original state. The trigger circuit output becomes positive and the condition of the current control switch again charges. This make the capacitor to charge by switching upper current source on. This process is a repetitive giving positive and negative pulses at a constant rate. The Schmitt trigger output is given to the trigger output circuit, 50 Ω and 600 Ω amplifiers. The trigger output circuit differentiates square wave output inverts the resulting pulse and provides positive trigger pulse.The generator can be synchronized to an external signal by triggering the circuit by an external synchronization pulse.

**Qus. 4) Attempt any four of the following:**

**a) Define calibration of instrument and explain need of calibration.**

**ANS: ( Definition- 2 mks, need – 2 mks)**

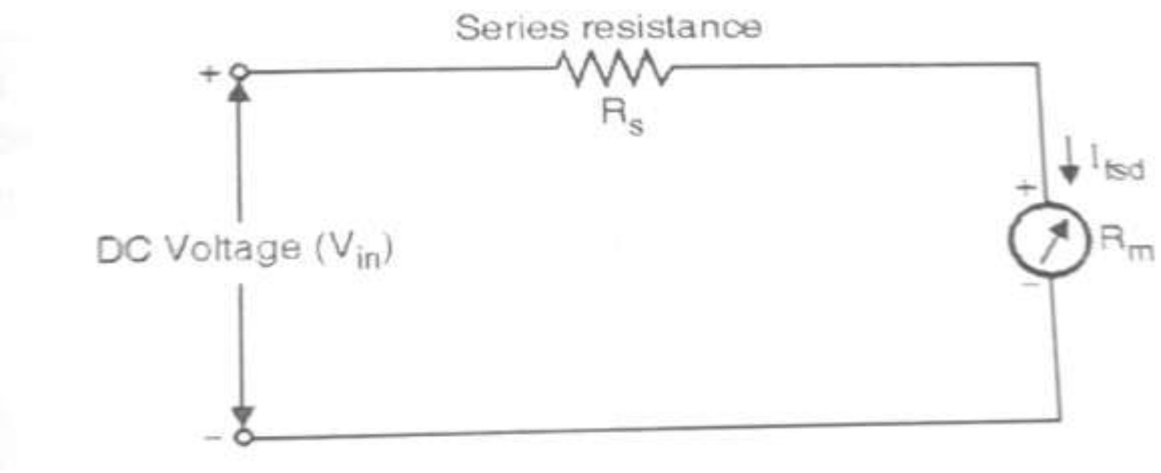
**Calibration :** Calibration is a process of estimating the value of a quantity by comparing that quantity with standard quantity. The standard with which comparison is made is called as standard instrument.

Need- The unknown quantity is to be calibrated. This quantity is called as test quantity. If an instrument is to be calibrated it is called as test instrument.For calibration the test instrument will be compared with the standard instrument.

Calibration of your measuring instruments has two objectives. It checks the accuracy of the instrument and it determines the traceability of the measurement. In practice, calibration also includes repair of the device if it is out of calibration. A report is provided by the calibration expert, which shows the error in measurements with the measuring device before and after the calibration.

**b) Draw the circuit of DC voltmeter and derive the equation of series resistance.**

**ANS: (Diagram= 2 marks, derivation= 2 marks)**



- The basic meter based on the PMMC D'Arsonval movement.
- In this case the current causes the deflection of meter.
- The current required to cause the full scale deflection of a meter is termed as full scale deflection current. It is denoted by $I_{fsd}$.
- The basic voltmeter is shown in figure.
- The basic meter can be converted into DC voltmeter by adding the series resistance. This series resistance is called as multiplier.
- The function of this resistance is to control the current passing to the meter.
- It does not allow the current to exceed the value of full scale deflection current. This series resistance is denoted by $R_s$.
- The DC voltmeter is used to measure the voltage drop between two points in DC circuit.
- To measure the DC voltage, the voltmeter is connected to this two points with proper polarity.
- Referring to figure we can write,

$$Vin = Ifsd(Rs + Rm)$$

Here, $I_{fsd}$ = Full scale deflection current.

$R_s$ = Series resistance (multiplier).

$R_m$ = Internal resistance of meter.

$V_{in}$ = input DC voltage.

- The value of multiplier should be selected properly so that the current does not exceed the value of $I_{fsd}$.
- From the equation we get,

$$Rs + Rm = \frac{Vin}{Ifsd}$$

$$\therefore Rs = \frac{Vin}{Ifsd} - Rm$$

Equation gives the value of series resistance (multiplier)

**c) Compare digital instrument with analog instrument. (4 points).**

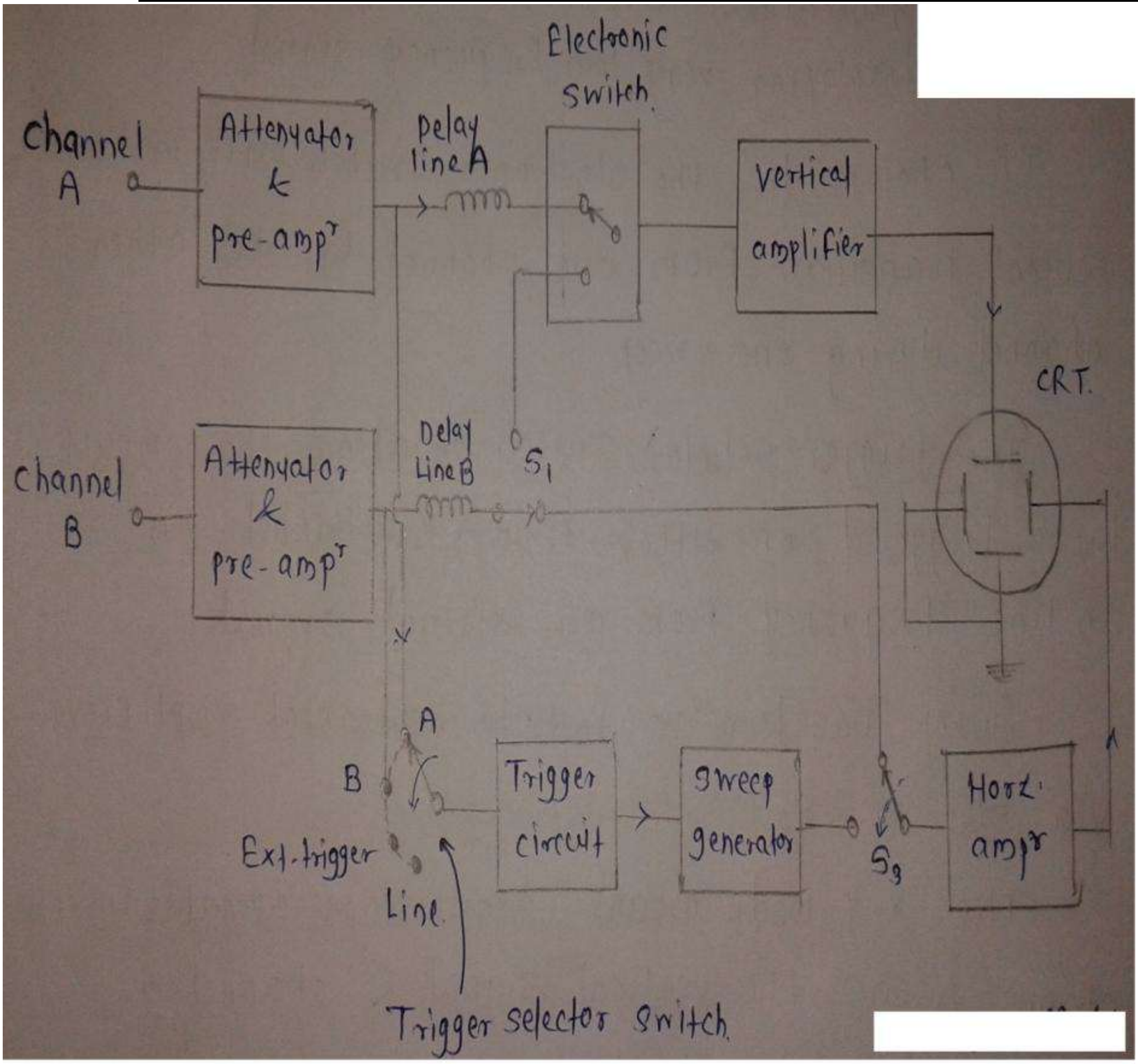
**ANS: (each point 1 marks)**

| Sr. No. | Parameter | Analog instrument | Digital instrument |
|---|---|---|---|
| 01 | Principle | The instrument that | The instrument that |

| | | | |
|---|---|---|---|
| | | displays analog signals is called as an analog instrument | displays digital signals is called as an digital instrument |
| 02 | Accuracy | Low | High |
| 03 | Resolution | Low | High |
| 04 | Power required | Require more power | Require less power |
| 05 | Cost | Cheap | costly |
| 06 | Portability | Portable | Less |
| 07 | Observational error | Considerable Observational error | Free from Observational error |
| 08 | examples | PMMC instrument, analog ammeter, analog voltmeter. | DMM, DVM |

**d) Explain the working of single beam dual trace CRO with the help of block diagram.**

**ANS: (block diagram = 2 mks, working = 2 mks)**




**Operation:** Fig. illustrates construction of single beam dual trace oscilloscope. There are two separate vertical input channels A and B. They use separate attenuator & pre-amplifier stages. Therefore the amplitude of each i/p as viewed on oscilloscope can be controlled individually. After completion of both channels are applied to electronic switch. This switch will pass one channel at a time to vertical amplifier via delay line.

There are two common modes for electronic switch called alternate & chop.

In “alternate mode” electronic switch connects the two channels A & B alternately in successive cycles of sweep generator. The alternate mode can not be used for displaying very low frequency signal.

In “Chop mode” electronic switch will make several transition from one channel to the other channel during one sweep.

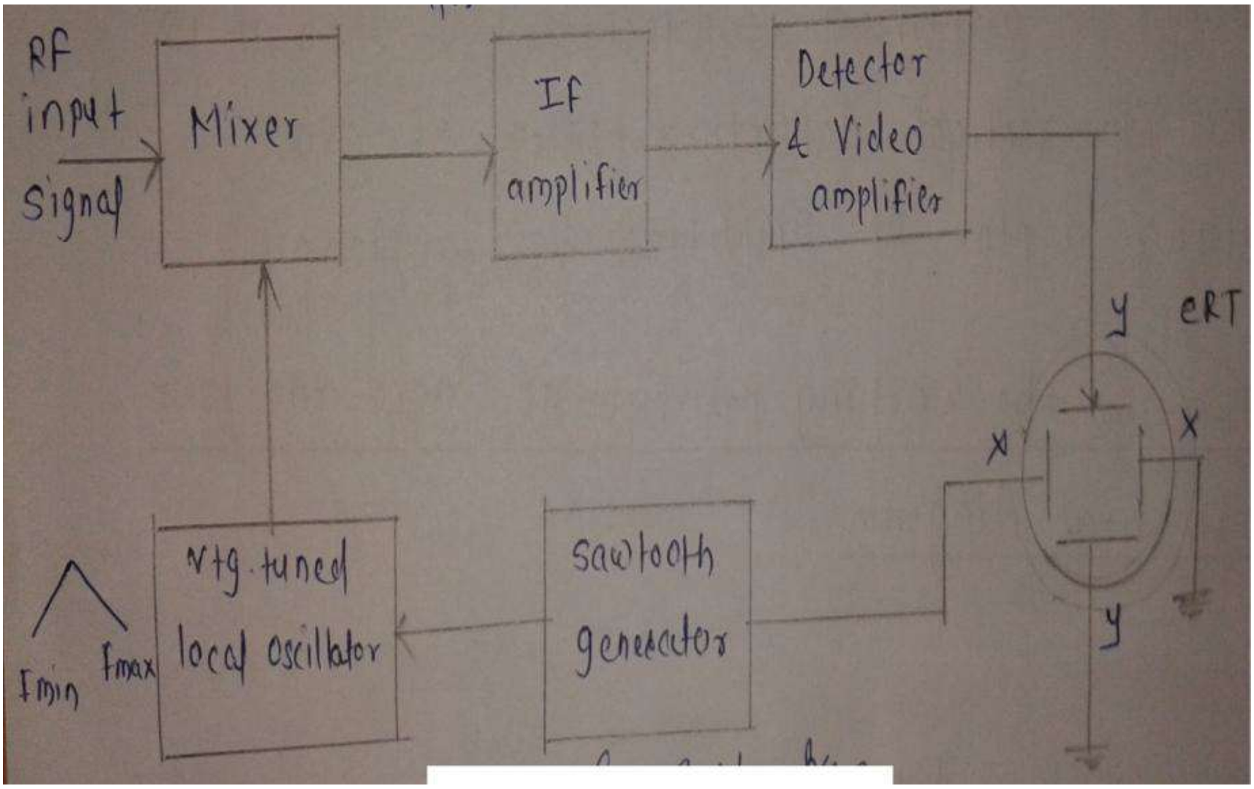
The trigger selector switch S2 allow the circuit to be triggered on either A or B channel on line frequency from an external signal.

Sweep waveform is fed to horizontal amplifier via s/w S1 & S3

The X-Y mode means, oscilloscope operates with channel A as the vertical signal & channel B as the horizontal signal. Accurate measurement can be done in thi mode.

e) **Draw the block diagram of spectrum analyzer. State any four applications of spectrum analyzer.**

**ANS: (block diagram = 2 mks, 4 applications = 2 mks)**




ANS: The application of spectrum analyzer are,

i) **Amplitude Modulation:**
   - When a carrier modulated with amplitude modulation, two sidebands are generated.
   - One Sideband is above the carrier frequency and the other sideband is below the carrier frequency.
   - The modulation frequency is equal to the separation between the carrier and the sidebands.

**ii) Frequency Modulation:**

- When a carrier is frequency modulated, sidebands are generated above and below the carrier frequency.
- The number of sidebands and the amplitude of thosesidebands can be found by the complex formulas which are based on Bessel Function.

**iii) Measurement of Harmonic Distortion:**

- The harmonic are additional signals which appear at the multiple of carrier frequency.
- The harmonic distortion affects the frequency components of the signal to be transmitted.
- The harmonic content of the signal should be kept low.

**iv) Pulse Modulation:**

- The Spectrum analyzers are useful to determine the pulse modulation of the radar transmitter.
- The structure of side bands indicates the rise and fall times of pulse modulations.
- The spectrum symmetry indicates the presence or absence of frequency modulations.

**v) Noise Measurement:**

- Using spectrum analyzer we can measure impulse noise.
- Impulse noise is the noise signal which in the time domain is a train of narrow pulses of low repetition rate.
- It is generate due to the voltage spikes which are generated o engine ignition and electric motor comutations.

**vi) Continuous wave Signal frequency Stability:**

- The Observation of the excursion of the signal across the display can be used in order to determine the frequency drift of a signal.
- It gives long term stability over a period of minutes and it gives short term stability over a period of seconds.

**vii)** It can be used in biomedical radar and oceanography. It is used to analyze the air and water pollution.

**Viii)** It can be used for the measurement of pulse width and repetition rat.

**IX)** It can be used to measure FM Deviation

**x)** It can be used for tuning a parametric amplifier.

**xi)** It can be used for the measurement of the antenna pattern.

**xii)** it is used for RF interference testing.

**xiii)** It is used to measure the modulation index of an AM Wave when used in the Synchroscope mode, i.e, the tune receiver is used to plot amplitude verses time.

**f) Explain the operation of digital frequency meter with the help of block diagram.**

**ANS: (block diagram = 2 mks, operations = 2 mks)**

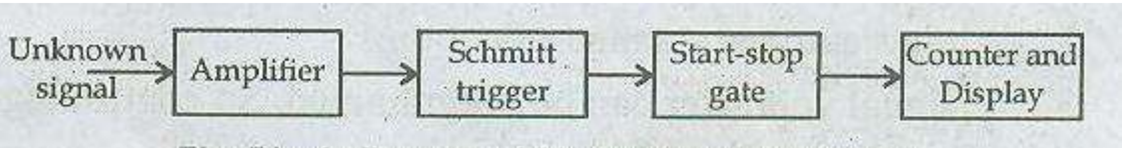


Fig. Block diagram of Digital Frequency Meter

**Digital frequency meter:**

Operation: Frequency is defined as number of cycles per unit time interval. The signal whose frequency is to be measured is used as an event. The unknown frequency is first converted to train of pulses. One pulse represents one cycle of unknown signal. These pulses are directly proportional to the frequency to be measured.

**Amplifier:** The signal whose frequency is to be measured is first amplified. The output of amplifier is applied to the Schmitt trigger.

**Schmitt trigger:** The Schmitt trigger converts the signal into square wave having fast rise and fall times. The square wave is then differentiated and clipped. Each pulse is proportional to each cycle of unknown signal.

**Start- Stop gate:** The output from Schmitt trigger is applied to start and stop gate. These pulses are applied to the switch. This switch is controlled by a signal having definite time interval. The main gate switch is closed for known time interval. When the gate is open, input pulses are allowed to pass through it. A counter will now start to count these pulses. When the gate is closed, input pulses are not allowed to pass through the gate. The counter will now stop counting.

**Counter and display:** The number of pulses during the period gate is open are counted by the counter. If this interval between start and stop condition is known, the frequency of unknown signal is measured.

F= N/t

Where,

F= Unknown frequency

N= Number of counts displayed by the counter.

t= Time interval between start and stop condition of the gate.

**Qus. 5) Attempt any four of the following: 16**

**a) Define sensitivity and loading effect of voltmeter.**

**ANS:**

**i) Sensitivity of voltmeter: (2M)**

The sensitivity of voltmeter means the response given by a voltmeter to input signal.

It is the ratio of total resistance (RT) to the voltage range

S = RT / V

Where, RT – Total resistance…… RT = RS + Rm

V= Voltage range.

**OR**

It is also defined as the reciprocal of full scale deflection current of the basic movement.

S = 1 / Ifsd

Ifsd = full scale deflection current.

**Loading effect of voltmeter: (2M)**

Sensitivity of meter plays an important role while selecting a voltmeter.

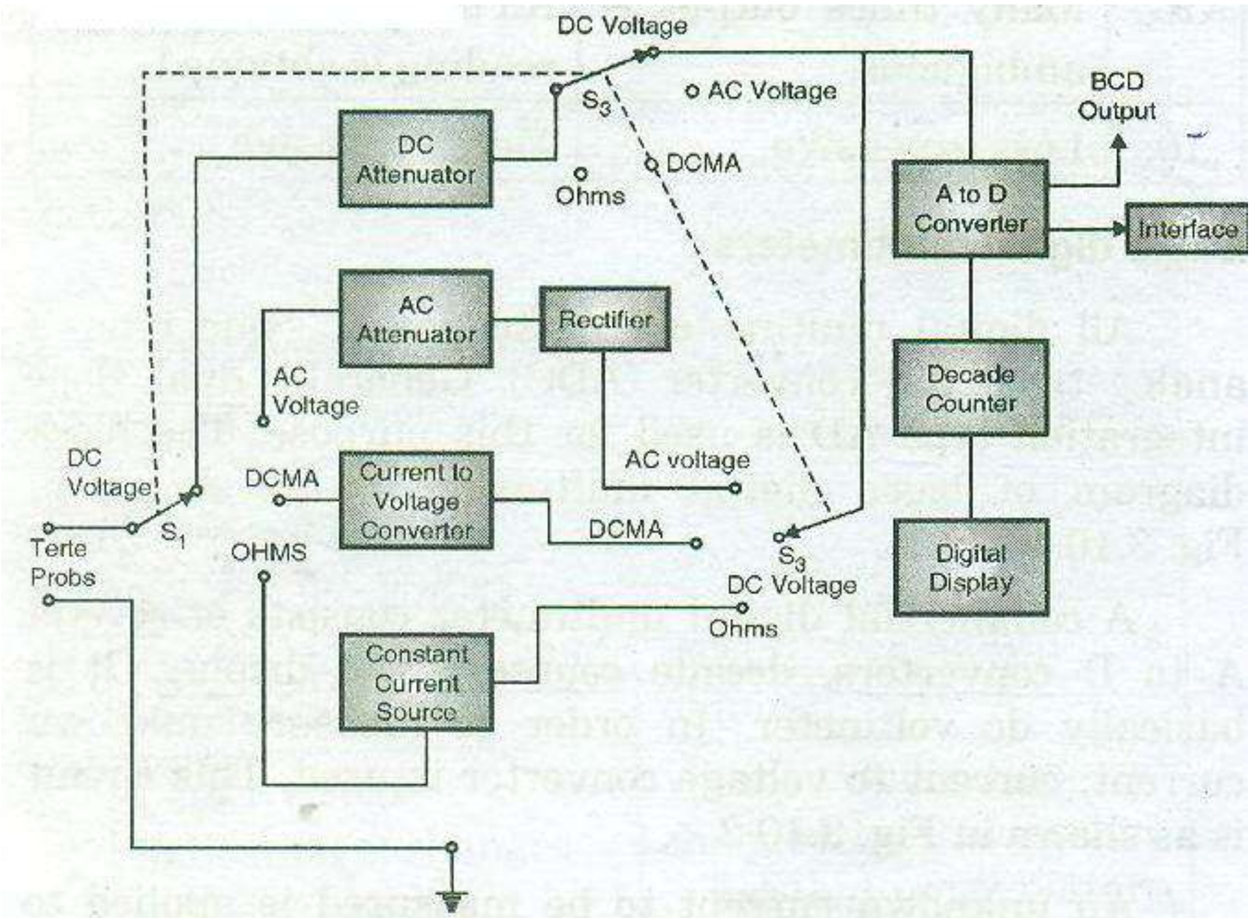
A low sensitivity meter gives accurate reading when it is used for the measurement of voltage in low resistance circuit, but it may give inaccurate reading during the measurement of voltage in high resistance circuit.

If voltmeter connects across low resistance, then most of the current will pass through low resistance and very less current flow through voltmeter because of its high resistance. The voltage drop is a measure of true value.

If the voltmeter is connected across high resistance then the current may be divided into two paths and voltage drop recorded by meter is lower than true value. This effect is known as loading effect.

**b) Draw the block diagram of digital multimeter and state how i) resistance ii) current is measured.**

**ANS: (block diagram = 2 mks, resistance = 1 mks, current = 1 mks)**




**Resistance:**

- Generally six resistance ranges are available. The resistance range is from 200Ω to 20MΩ.
- Accuracy is about ±0.1% of reading.

**DC current:**

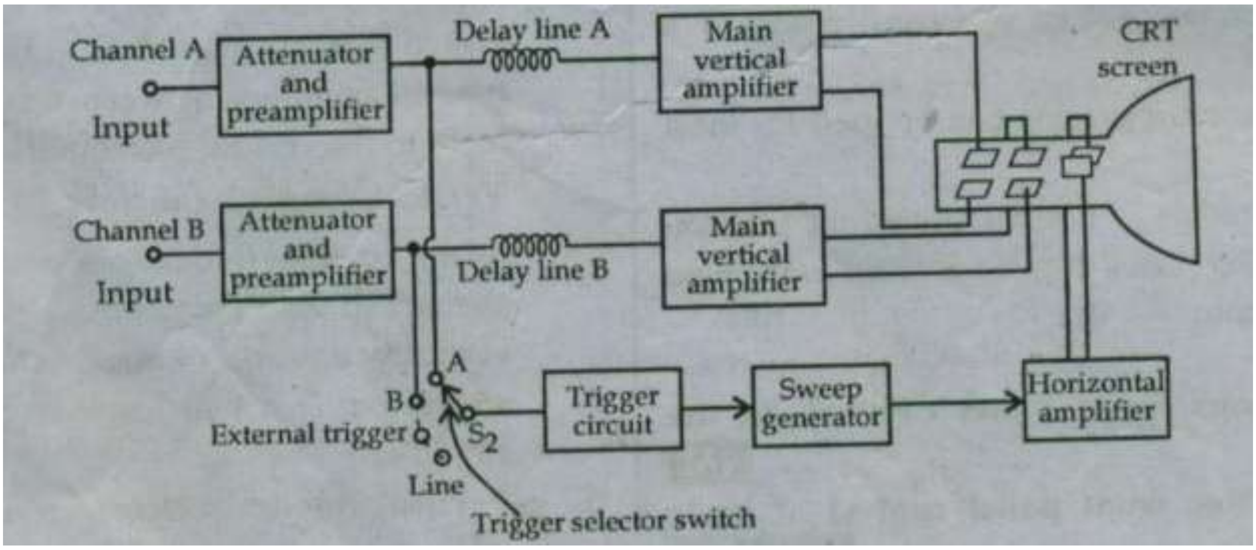
- Five ranges are available. This range is from ±200µA to 2Amp.
- Accuracy is about ±0.3% of reading.
- Resolution is about ±0.01µA.

**AC current:**

- Five current ranges are available. This range is from 200µ to 2 Amp.
- Accuracy is dependent on frequency. Best accuracy obtained is about ±1%.

**c) Draw the block diagram of dual beam dual trace CRO and state function of each block.**

**ANS: (block diagram = 2 mks, functions = 2 mks)**




ANS: Operation:

- Ina dual beam CRO, there are two separate vertical input channel A and B. They use separate preamplifier and attenuator stages.
- Because of this arrangement it is possible to control the amplitude of each input independently.
- It has one horizontal deflection plate so sweep for both the signals in the same. This indicates that a common time base is used for both the beams.

- So, one sweep can be synchronized at one time also both the signals should have same frequency or frequency should be related harmonically to obtain the beams on the CRT Screen.
- The sweep generated can be triggered by Channel A & Channel B or external Signal or LINE frequency signal.

**d) Describe working of distortion factor meter with the help of the diagram.**

**Ans :** **(2M)**

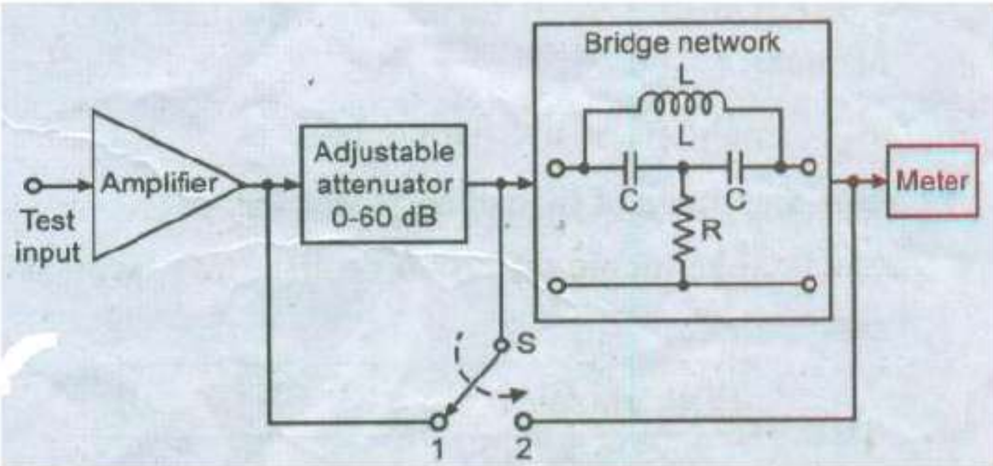



Fig. Distortion factor meter

**Distortionmeter** (or distortion factor meter) is an electronic measuring instrument which displays the amount of distortion added to the original signal by an electronic circuit

**Working** : **(2M)**

- Initially the switch S is kept at position 1.
- The attenuator gets excluded and the bridge T network is adjusted for full suppression of fundamental frequency and hence we get minimum output condition.
- This condition indicated that the bridge T network is tuned to the fundamental frequency with full suppression of it.
- Then switch is moved at position 2, then the bridge T network is excluded.
- The attenuator is adjusted such that same reading as previous is obtained on the meter.
- Thus the total rms distortion is indicated by the reading of attenuator.

**e) Draw the labeled block of dual slope integrating type DVM. State its operation.**

**ANS: ( diagram = 2 mks, operation = 2 mks)**

At the start of measurement the counter is reset to zero. So output of flip flop is zero. This is applied to the switch control. The switch control now connects input voltages (Vin) to the integrator.

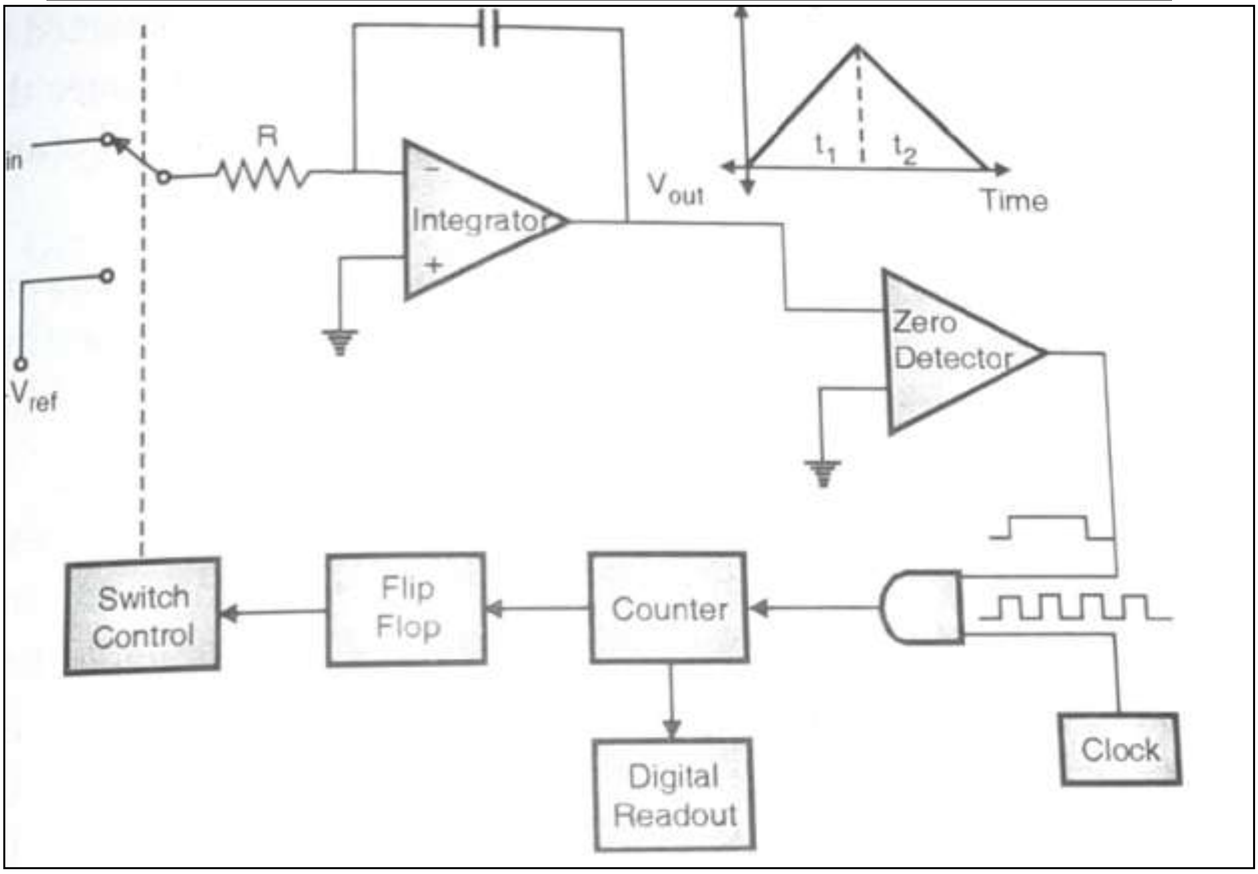
Integrator now starts integrating the inpt voltage. That means the capacitor starts charging. Because of this the output of integrator changes from zero value. It causes the zero detector (comparator) to change is stage. That means it provides a high signal to the logic gate. Thus the opening of logic gate takes place.

When the logic gate is opened, the number of clock pulses is passed to the counter. The counter will count these pulses for certain time t1. After this time the counter is reached to 999. After this ‘1’ passed to flip- flop.

The output of flip –flop is now ‘1’. This is connected to the control logic. The switch control logic now changes the position of switch from Vin to Vref. So integrator will starts integrating this reference voltage (-V ref).

This will cause the capacitor to start discharging. The discharging of capacitor will take place for the time period. The discharging path is having a constant negative slope. This slope is as shown in Fig.

A stage will be reached at which output of integrator becomes zero. This stage is obtained at the end of time period t2. At this instant the potput of zero detectors gets changed. This will cause the closing of logic gate. Now the pulses from clock are not allowed to pass towards the counter. The counting operation is completed. Then the data from counter is passed to the digital readout for display purpose.




**f) List out any four front panel control of basic CRO with their functions.**

**ANS: ( any 4 controls with functions 4 marks)**

**General Purpose Controls:**

**i)Power ON/OFF:**

An ON/OFF control is used to turn ON/OFF the CRO. With this switch we turn ON or OFF the ac supply that is connected to the CRO.

**ii) Intensity control:**

- The intensity control is actually a potentiometer which controls the negative voltage applied to the control grid.
- By varying this voltage we actually control the number of electrons that are transmitted from the cathode of the electron gun in the CRT.
- As the brightness of the spot produced on the screen depends on the number of electrons striking the screen, it is possible to control the intensity in this way.
- The intensity should not be excessive because it reduces the screen life and it becomes difficult to get a sharp and thin spot due to dispersion of light.

**iii) Focus Control:**

- The focus Control is used to obtain a sharp, well focused spot. This is by varying the voltage applied o the focusing anode.
- The focus controls is a potentiometer which controls the voltage to the focusing anode in the CRT.

**iv) Trace rotation:**

- If the trace is not exactly horizontal due to reasons like the presence of external field or disturbances in the internally generated field then it is impossible to make the traces perfectly horizontal by the "trace rotation" controls, with the help of screw driver.

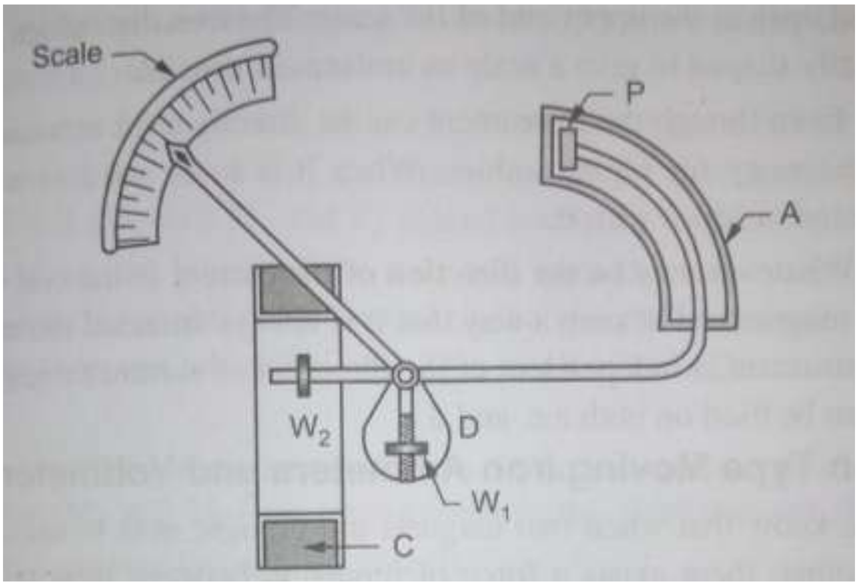
**v) Calibration:**

- It provides a standard signal to calibrate the vertical amplifier control. In most of the oscilloscope it is a square wave signals 0.2 Volt, 1 KHz.

**Qus. 6) Attempt any four of the following:**

**a) Explain the working of analog AC ammeter with the help of diagram.**

**Ans:- ( diagram= 2 mks, explanation = 2 mks)**



**Operation :** When the current to be measured is passed through the fixed coil C, the magnetic field is produced. When the coil is excited in this manner, it becomes an electromagnet and attracts the eccentrically mounted soft iron disc inwards. This results into the deflection of the pointer over a calibrated scale.

The force with which the iron disc is attracted is dependent on relative pole strengths of the coil which works as an electromagnet and the magnetized iron disc. These pole strengths in turn, are decided by the field strength produced by the current (I) passing through the coil.

Therefore, Deflecting torque $(T_d) \propto \begin{bmatrix} \text{Pole strength of} \\ \text{the pole of the coil } M_1 \end{bmatrix} \times \begin{bmatrix} \text{Pole strength of} \\ \text{the magnetized} \\ \text{iron disc } (M_2) \end{bmatrix}$

i.e. $(T_d) \propto M_1 M_2 \propto I^2$

**Scale :** $T_d \propto I^2$ and $T_c \propto \theta$ (with spring control)

Therefore, $\theta \propto I^2$ ... (4.4)

As the deflection follows a square law, scale of the instrument is non-uniform, being cramped at the beginning and open at the upper end of the scale. The iron disc which is used in this type of instrument is specially shaped to give a scale as uniform as possible.

**Connections :** Even though the instrument can be directly used to measure small amounts of current, shunt is necessary for higher values. When it is to be used as a voltmeter, a suitable resistance is connected in series with it.

**Application :** Whatever may be the direction of the current in the coil of the instrument, the iron disc is always magnetized in such a way that it is always attracted towards the coil. Thus, the operation of the instrument is independent of the direction of current through the coil. Therefore, such instruments can be used on both a.c. and d.c.

**b) Compare successive approximate type DVM with linear ramp type DVM (4 points).**

**ANS: ( 4 points 4 mks)**

| SR.NO | SUCCESSIVE APPROXIMATE TYPE DVM | LINEAR RAMP TYPE DVM |
|---|---|---|
| **1** | Unkonwn voltage is successively compared with the output of digital to analog converter. | Unkonwn voltage is compared with either positive or negative going ramp. |
| **2** | Output reading is obtained after successive decisions taken by logic circuit so the probability of | Probability of error in the output reading is less. |

| | | |
|---|---|---|
| | error in output reading is more. | |
| **3** | Output signal cannot be easily digitized. | Since the output is in terms of time, this signal can be easily digitized. |
| **4** | Speed of operation is less. | Speed of operation is more. |
| **5** | Resolution upto maximum 5 digits can be obtained. | Resolution is directly proportional to the frequency of local oscillatory and it can be improved by increasing this frequency. |
| **6** | Accuracy depends on accuracy of internal reference and accuracy of digital to analogue converter. | Accuracy depends on linearity and slope of ramp as well as it depends on stability of local oscillator. |

**c) Describe the methods of measurement using CRO:**

**i. Voltage measurement.**
**ii. Current measurement.**
**iii. Time period measurement.**
**iv. Frequency measurement.**

**ANS: (each method 1 mks)**

**Voltage measurement:**

- The most direct voltage measurement that can be made with the help of oscilloscope is the peak to peak value.
- The RMS value can be calculated from peak to peak value.
- In order to measure the voltage from the CRT display, one must observe the vertical attenuator expressed in volts/div and the number of division of the beam. The peak to peak value is then computed as,

$$Vp-p = \left(\frac{Volts}{Div}\right) \times \left(\frac{number\ of\ divisions}{1}\right)$$

$Vp = \frac{1}{2} Vpp\ is\ the\ peak\ value.$

- The Root mean square value (RMS value ) is 0.707 times the peak value.

$$Vrms = 0.707 \times Vp$$

$$Vrms = \frac{1}{\sqrt{2}}Vp$$

$$\boldsymbol{Vrms = \frac{1}{2\sqrt{2}}Vp - p}$$

**Current measurement:**

- To make the oscilloscope more versatile as a bench instrument along with AC/DC measurement of voltages, it should also be able to measure current. This current is must be converted to voltage before applying to the vertical input.
- If DC current is passed to some semiconductors, and if the magnetic field is applied perpendicular to the crystal (i.e. path of electrons) , then there will be generation of the voltage across the dimensions of the crystal. This voltage are proportional to the applied current level.

**Time period measurement:**

- This interval is the distance between two points within one cycle or several cycles of the waveform.
- In order to do the measurement first align the reference point on a graticule line using horizontal position control.

$$Tinterval = number\ of\ divisions \times \left(\frac{time}{div}\right)$$

**Frequency measurement:**

- The period and frequency of periodic signals are easily measured.
- The period is the time between two identical points of successive cycle of the waveform.

$$Period = Number\ of\ divisions\ \times poisition\ of\ \frac{time}{div}knob$$

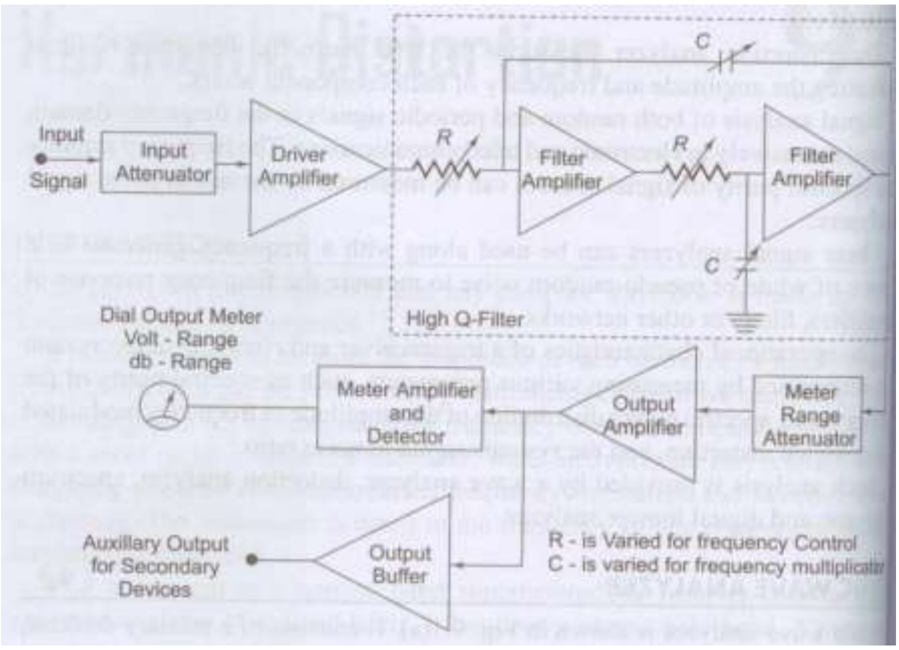
- The frequency is inversely proportional to the period.

$$\boldsymbol{Frequency = \frac{1}{period}}$$

**d) Explain working of frequency selective wave analyzer with the help of diagram.**

**ANS: (diagram = 2 mks, explanation = 2mks)**

The wave analyzer consist of vary narrow pass- band filter section which can be tuned to a particular frequency within the audible frequency range (20 Hz- 20 kHz). The block diagram of the wave analyzer is shown in figure.




The complex wave to be analyzed is passed through an adjustable attenuator which serves as a range multiplier and permits a large range of signal amplitudes to be analyzed without loading the amplifier.

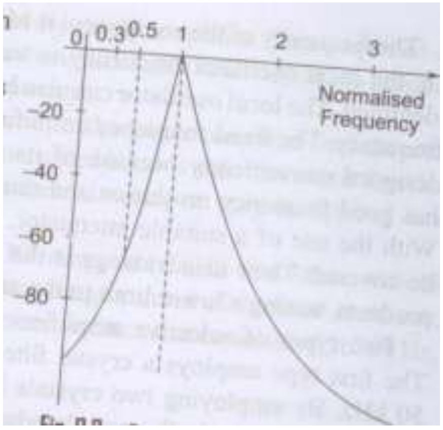
The output of the attenuator is then fed to a selective amplifier which amplifies the selected frequency. The driver amplifier applies the attenuator input signal to a high-Q active filter. This high-Q filter is a low pass filter which allows the frequency which is selected to pass and reject all others. The magnitude of this selected frequency is indicated by the meter and the filter section identifies the frequency of the component. The filter circuit consist of a cascaded RC resonant circuit and amplifiers. For selecting the frequency range the capacitor is generally used are a closed tolerance polystyrene type and the resistances used are precision potentiometers. The capacitor are used for range changing and the potentiometer is used to change the frequency within the selected pass-band, Hence this wave analyzer is also called frequency selective voltmeter.

The entire AF range is covered in decade step by switching capacitors in the RC section.

The selected signal output from the final amplifier stage is applied to the meter circuit and to an unturned buffer amplifier. The main function of the buffer amplifier is to drive output devices such as recorders or electronic counters.

The meter has several voltage ranges as well as decibel scales mark on it. It is derive by an average reading rectifier type detector.

The wave analyzer must have extremely low input distortion, undetectable by the analyzer itself. The bandwidth of the instrument is very narrow, typically about 1% of the selective band given by the following response characteristics shown in figure.




**e)Draw the block diagram of digital storage oscilloscope. Write functions of each block.**

**ANS: (block diagram = 2 mks, functions = 2 mks)**

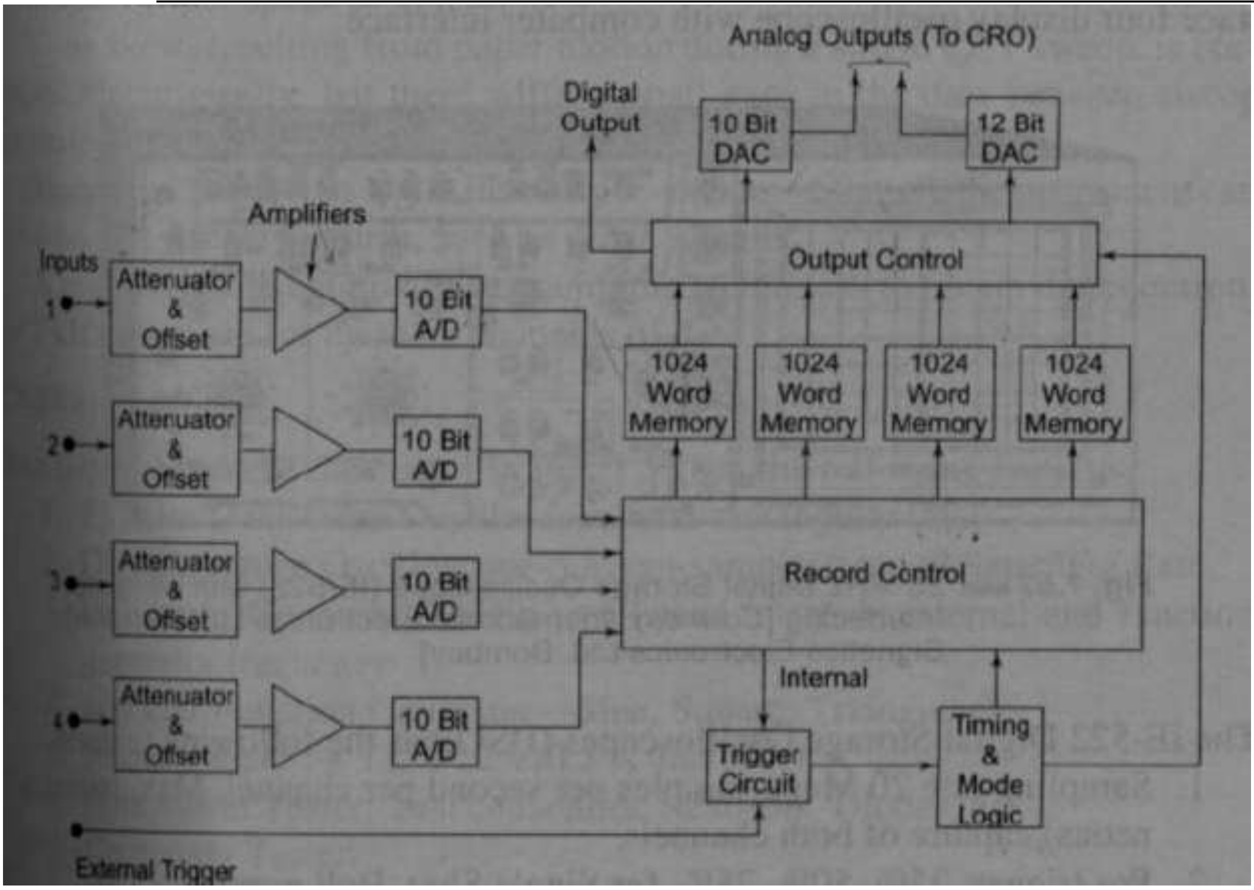



**Fig. Block diagram of Digital Storage Oscilloscope**

The analog voltage input signal is digitized in a 10 bit A/D converter with a resolution of 0.1% (1 part in 1024) and frequency response of 25 kHz. The total digital memory storage capacity is 4096 for a single channel, 2048 for two channels each and 1024 for four channels each.

The analog input voltage is sampled at adjustable rates (Upto 100, 000 samples per second) and data points are read onto the memory. A maximum of 4096 points are storable in this particular instrument. (Sampling rate and memory size are selected to suit the duration and waveform of the physical event being recorded.)

Once the sample record of the vent is captured in memory, many useful manipulations are possible, since memory can be read out without being erased.

If the memory is read out rapidly and repetitively, an input event which was a single shot transient becomes a repetitive or continuous waveform that can be observed easily on an ordinary scope(without going through DAC) to say a computer where a stored program can manipulate the data in almost anyway desired.

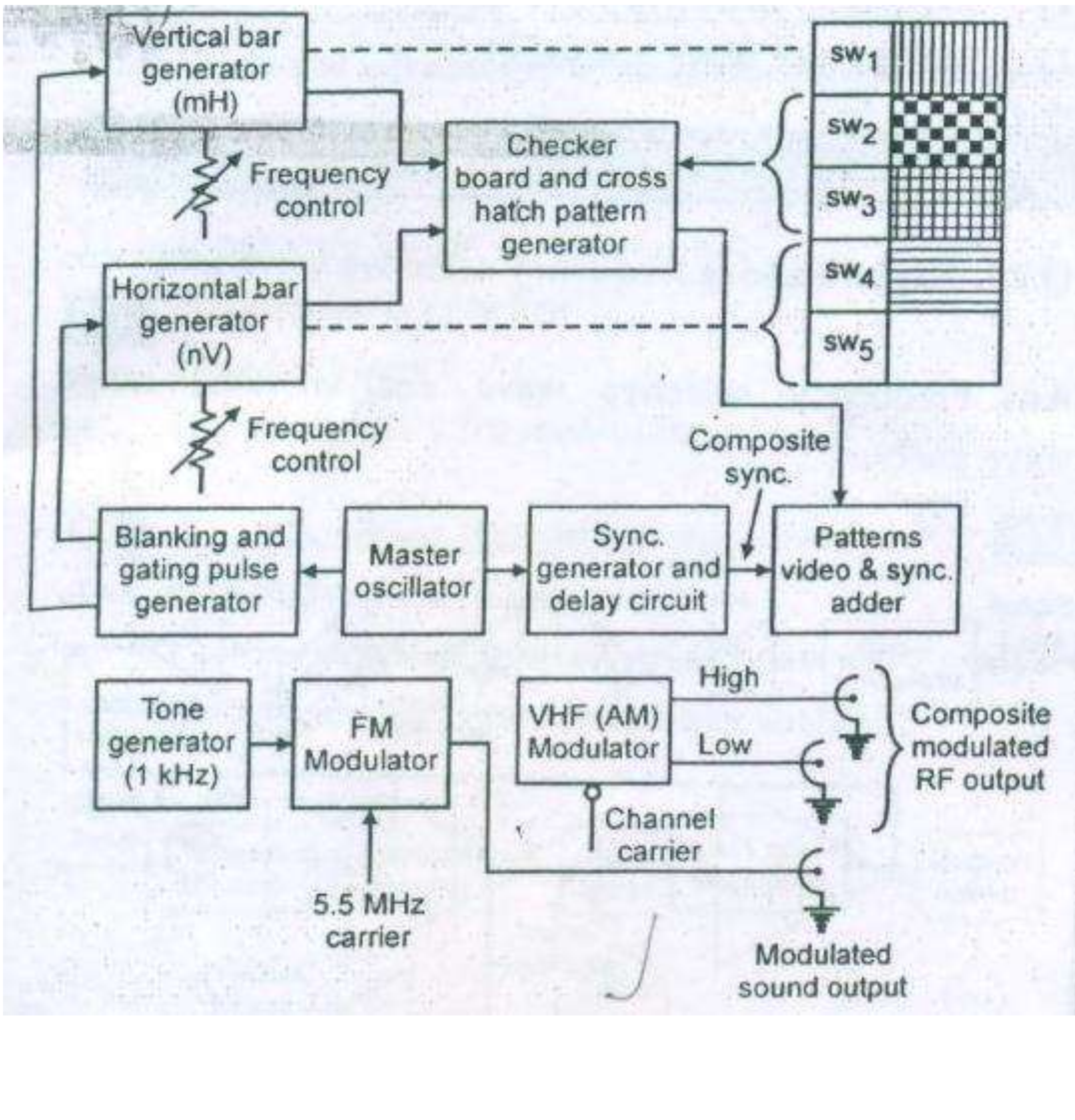
Pre triggering recording allows the input signal preceding the trigger points to be recorded. In ordinary triggering the recording process is started by the rise of the input (or some external triggering) above some preset threshold value.

As in digital recorder, DSO can be set to record continuously(new data coming into the memory pushes out the old data, once memory is full), until the trigger signal is received; then the recording is stopped, thus freezing data received prior to the trigger signal in the memory.

An adjustable trigger delay allows operator control of the stop point, so that the trigger may occur near the beginning, middle or end of the stored information.

**f) Draw the block diagram of video pattern generator. State the uses of various pattern generated by pattern generator.**

**ANS: ( block diagram = 2 mks, any 2 pattern 2 mks)**



Uses of generated patterns **(2M)**

- A pattern generator is a device which can generate video signals that can be fed to a TV or Video monitor.
- The pattern consists of geometrical figures such as circles, ellipses, checker boards, horizontal /vertical lines, dots etc.
- These patterns enable us to adjust, test and service the TV monitors. It is essential to generate different pattern to differentiate between video and audio signals for alignment, testing and servicing of Television receivers.