MODEL ANSWER

SUMMER– 17 EXAMINATION

Subject Title: Electronic Instruments and Measurements Subject Code: 17317

Important Instructions to examiners:

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

Q 1 A) Attempt any six of the following: 12M

a) Define precision and fidelity.

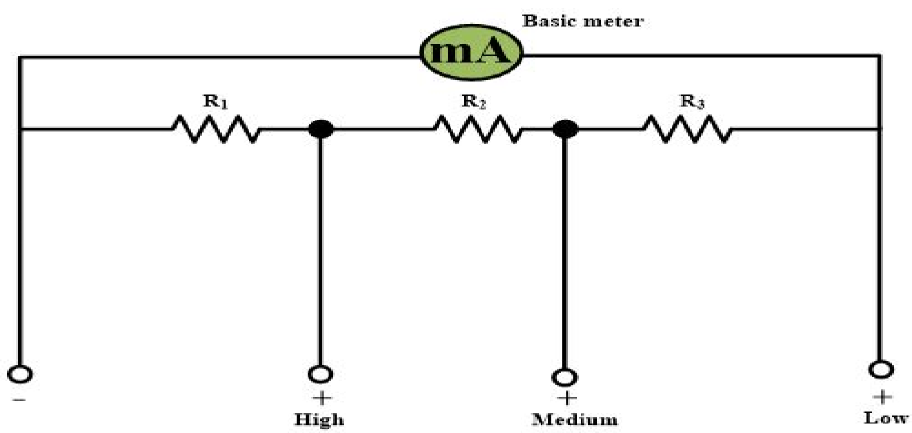
ANS:

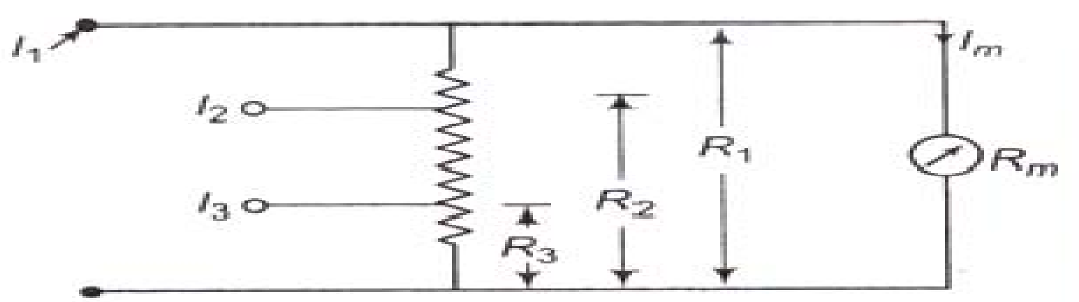
Precision: (1 M)
The measure of the degree to which successive measurements differ from each other is known as precision.

Fidelity: (1M)
The degree to which instrument indicates the change in measured variable without dynamic error is called as fidelity.

b) Draw the circuit diagram of multirange current meter with and without Aryton shunt.

ANS:- (1 MKS EACH)





Ayrton shunt circuit

c) State two advantages of digital instruments.

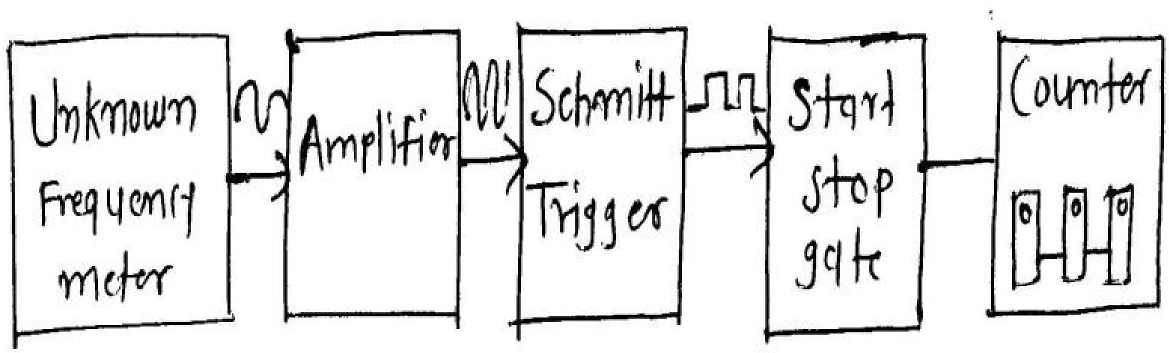
ANS: (each 1M)

Advantages of digital instruments:

1. They are having high input impedance, so there is no loading effect
2. They are having higher accuracy
3. An unambiguous reading is obtained
4. The output can be interfaced with external equipment
5. They are available in smaller size .

d) State the principal of digital frequency meter.

ANS: (principle- 2M)diagram- optional

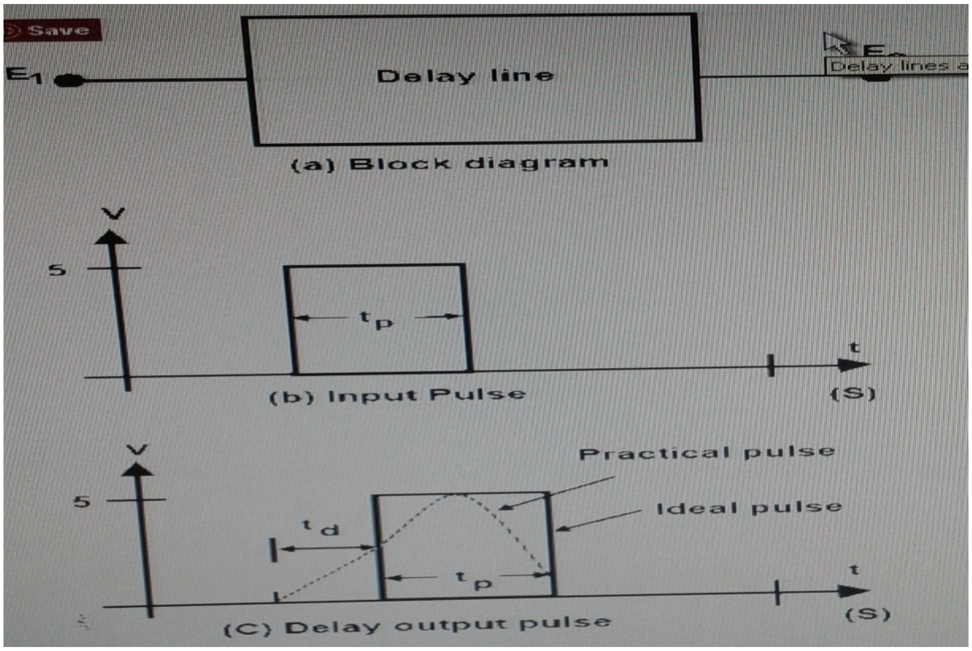


Principle:
The signal may be amplified before being applied to the Schmitt trigger. The Schmitt trigger converts the input signal into a square wave with fast rise and fall times, which is then differentiated and clipped. As a result the output from the Schmitt trigger is a train of pulses, one pulse for each cycle of the signal. The output pulses from the Schmitt trigger are fed to a START / STOP gate. When this gate is enabled, the input pulses pass through this gate and are fed directly to the counter which counts the number of pulses. When gate is disabled the counter stops counting the incoming pulses. The counter displays the number of pulses that have passed through it in the time interval between start and stop. If this interval is known the pulse rate and hence the frequency of the input signal cab be known. If f is the frequency of unknown signal, N is the number of counts displayed by counter and t is the time interval between start and stop gate then, frequency of unknown signal is,
f = N / t

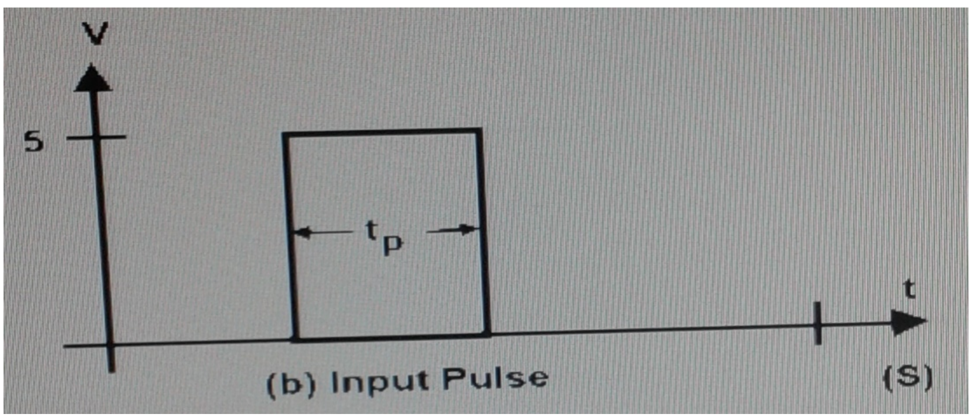
e) Draw the waveform displayed on the CRO with delay line and without delay line.

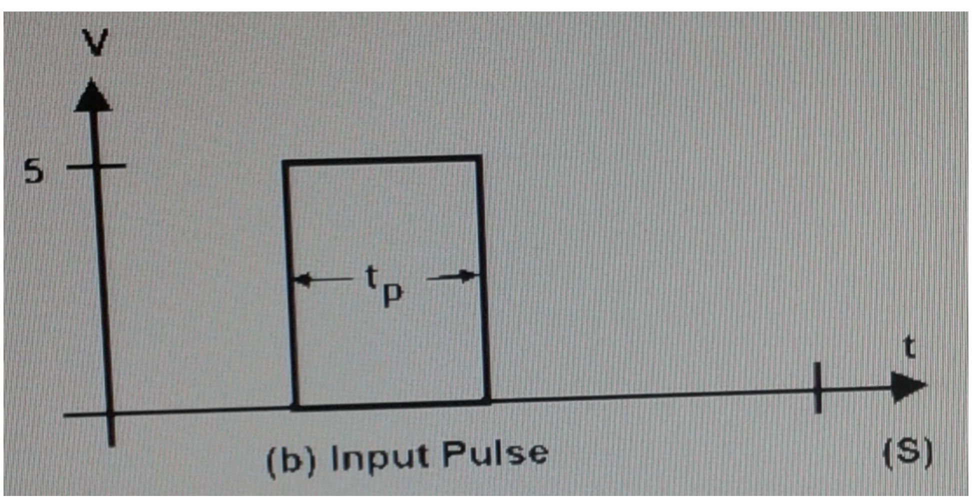
ANS: (each 1M)

Delay line:



Without delay line:





f) **Write the formula for frequency measurement and phase measurement with lissajeous figure.**

ANS: (each 1M)

The frequency is calculated using the expression:

Frequency = $\frac{no. of\ horizontal\ tangent}{no. of\ vertical\ tangent}$

The phase difference is calculated using the expression:

$$\emptyset = sin^{-1}\frac{Y_1}{Y_2} = sin^{-1}\frac{X_1}{X_2}$$

g) What are the outputs of function generator?

ANS: (each 1M)

The outputs of function generator are:

1) Square wave.
2) Sine wave.
3) Triangular wave.

h) State the two applications of spectrum analyzer.

ANS: (each 1M)

Applications of Spectrum Analyser are as follows:

i) It is used to study the RF spectrum produced in microwave instrument.

ii) It is used for testing of RF interference.

iii) It is used for measurement of antenna pattern.

iv) It is used for measurement of pulse width and repetition rate.

v) It is used for measurement of harmonic distortion.

vi) The spectrum analyzers are useful to determine the pulse modulation of radar transmitter.

vii) It can be used to biomedical, radars and oceanography.

viii) It is used to analyze the air and water pollution.

ix) It can be used to measure FM deviation.

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

xi) It is used to measure the modulation index of an AM wave.

B) Attempt any two of the following: 8M

a) Define error. Write the formula for absolute error and % error. Write the cause of any one type of error.

ANS: (define – 1 mks, each formula- 1 mks, causes – 2 mks)

Error:

It is also called as static error. It is the deviation from the true value of the measured variable. It involves the comparison of unknown quantity with an accepted standard quantity. The degree to which an instrument approaches to its excepted value is expressed in terms of error of measurement. Error may be either absolute error or percentage error.

Absolute error is the result of comparison between the expected value of the variable and the observed value of the variable.

Mathematically,

$$e = Ae - Am$$

Where, e : Error

Ae : expected value of variable

Am : Measured or observed

Value of the variable.

Percentage error is defined as the ratio of the absolute error to the expected value of the variable when expressed in percentage.

$$\therefore \%\ error = \frac{absolute\ error}{expected\ value} \times 100$$

$$\%\ error = \frac{e}{Ae} \times 100 = \left(\frac{Ae - Am}{Ae}\right) \times 100$$

It is more frequently expressed as accuracy, rather than error is called as relative percentage error.

$$Accuracy = 1 - relative\ error$$

$$\therefore A = 1 - \left|\frac{Ae - Am}{Ae}\right|$$

When A: relative accuracy

% accuracy = A X 100%

$$\% accuracy = \left[1 - \left|\frac{Ae - Am}{Ae}\right|\right] \times 100\%$$

The error can also be expressed as a percentage of full scale reading.

$$\% e = \frac{Ae - Am}{full\ scale\ deflection} \times 100$$

b) Describe the different types of standards.

ANS: (Different types- any 4- 1 mks)

1) International standards:

a. International standards are fixed and develop by international agreement.
b. These standards are maintained at International Bureau of Weights and Measures in France. This standard gives different unit having best accuracy.
C. To preserve best accuracy these standards are periodically check by absolute measurement.
d. These standards are used to calibrate primary standard only.
e These are not available to ordinary user for measurement.

2) Primary standards :

a These standards are preserved and maintained by National Standard Laboratories which are located at different part of the world. E.g.-NBS (National Bureau of Standards) located at Washington. These standards are periodically calibrated by International standards.

3) Secondary standards:

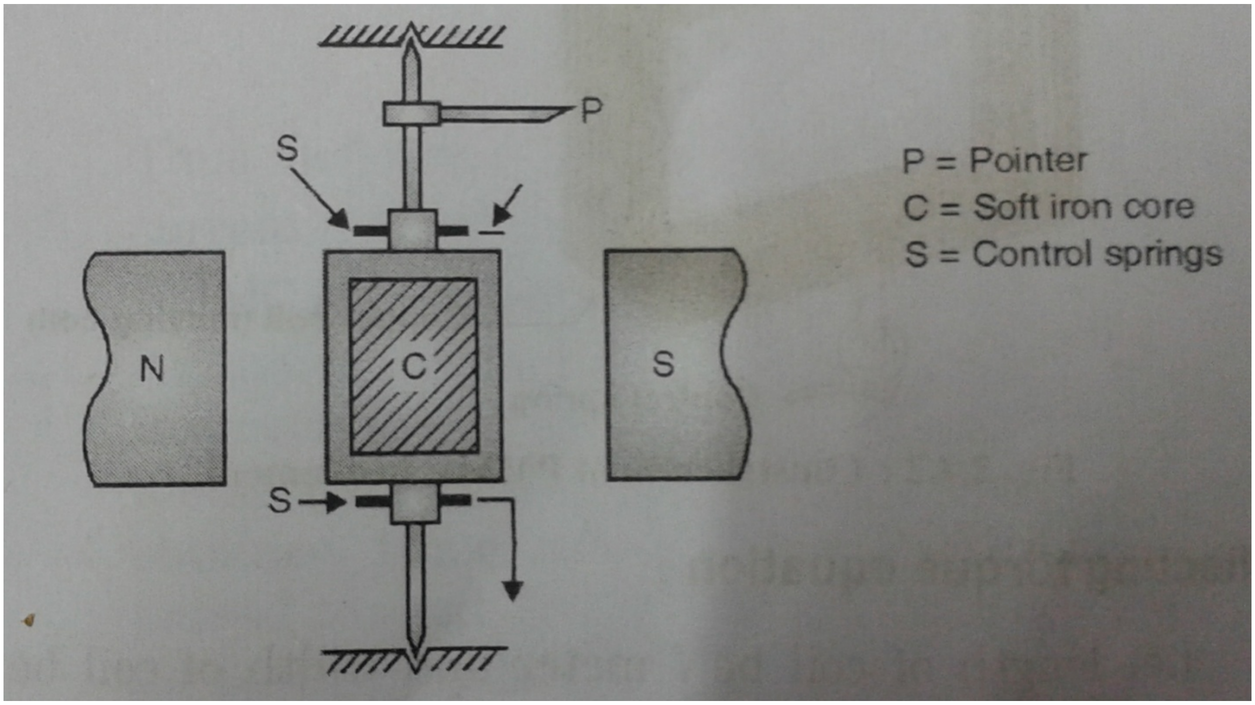
a. These standards are also called as basic standards.
b. These standards are used by industries and calibration laboratories.
c.Each industry has its own laboratory.

4) Working standards:

a. These standards are used in general laboratories.
b. These standards are used to check components and calibrating laboratory instruments to achieve good accuracy and better performance.

c) Draw the neat diagram of D'Arsonval movement meter. Derive the formula for torque of it.

ANS: (2M –diagram, derivation – 2 mks)



Let length of coil be l meter and width of the coil be d meter. Assume I is the current flowing in coil having N turns. Assume B as the flux density in the air gap.

Then, F= BIL(N)

Torque on each side of coil = F X d/2

Total torque = $2\left[BIL N.\frac{d}{2}\right] = BILdN$ newton meter

For a given instrument B, L, d and N are constants.

$\therefore T\ deflecting \propto I = GI(say)$

Where G= B.L.d.N

Controlling torque = Tc

= C.θ

Where C= control spring constant in N-m/rad

θ= deflection of coil from zero position.

For steady state, the controlling torque is equal to the deflection torque

$\therefore Tc = Td$

$i.e. C\theta = GI$

$\therefore \theta \propto I$

Thus the deflection of the pointer is proportional to current passed tom the coil. Hence the scale of PMMC instruments is a uniform scale.

2. Attempt any four of the following: 16M

a) Define calibration and the need of calibration for measuring instruments.

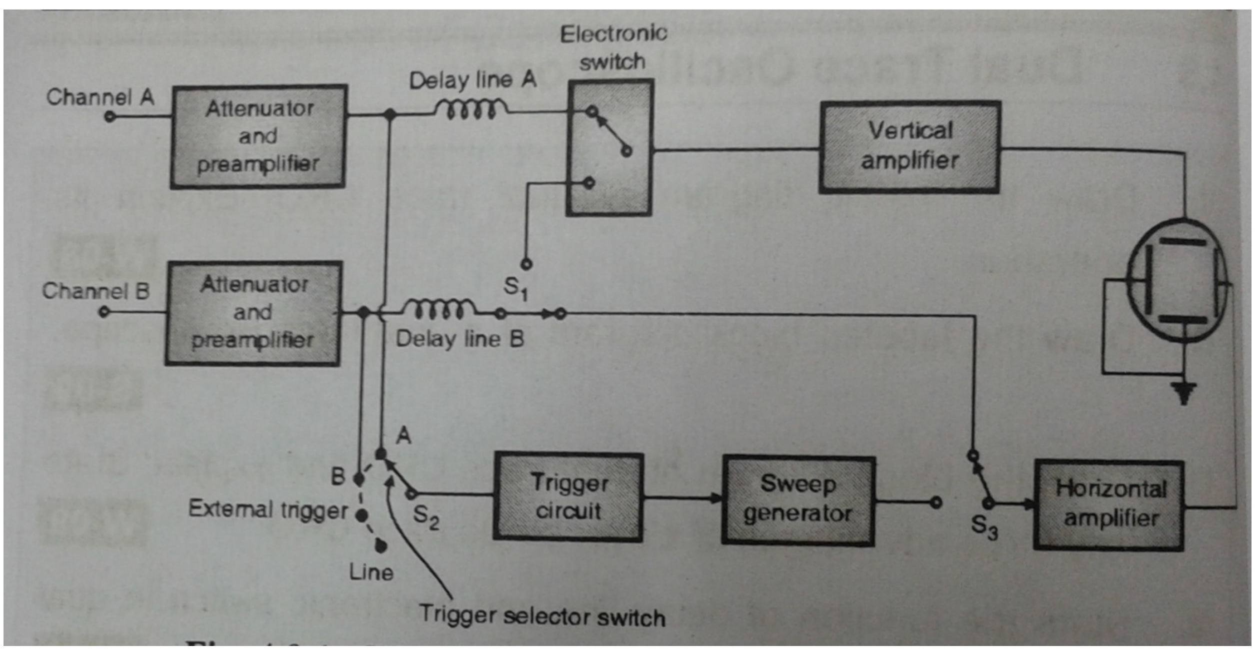
ANS: define- 2 mks, need – 2 mks

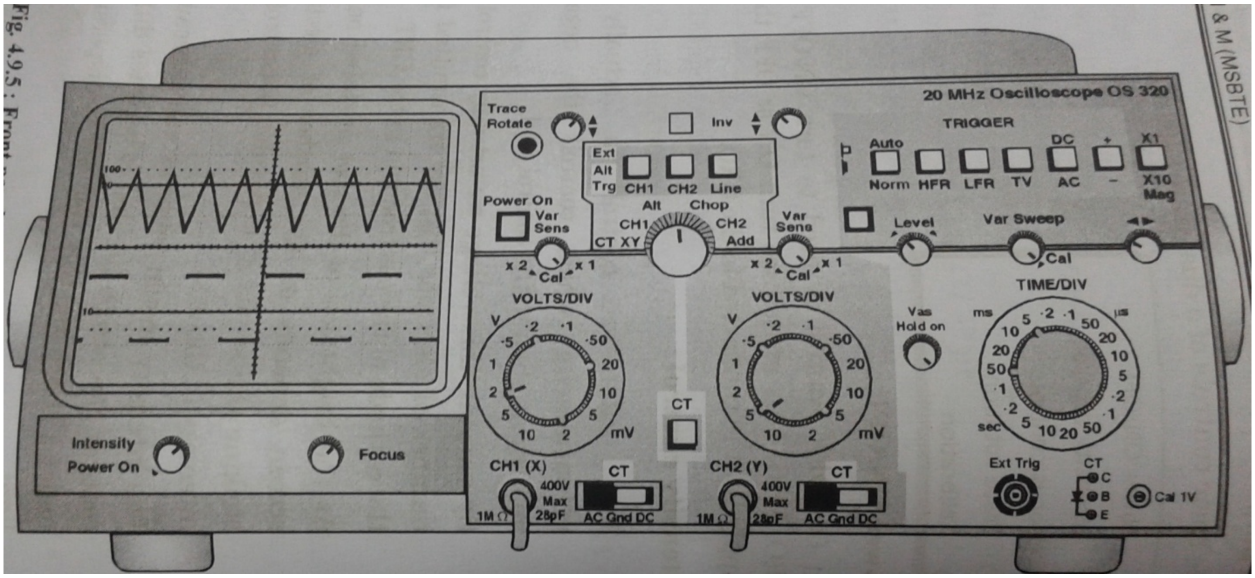
Calibration - It is a process of estimating the value of a quantity by comparing that quantity with a standard quantity.

Need of calibration: - Calibration defines the accuracy and quality of measurement recorded using a piece of equipment. Over time there is a tendency for result and accuracy to drift particularly using measuring particular parameters such as temperature and humidity. To be better result being measured there is an ongoing need to service and maintain the calibration of equipment throughout its lifetime for reliable, accurate and repeatable measurement. The aim of calibration is to minimize any measurement uncertainty by ensuring the accuracy of test equipment.

b) Draw the block diagram of dual trace CRO and show the controls –V/div, time/div, intensity, X-Y in the block diagram.

ANS: (2 mks each)

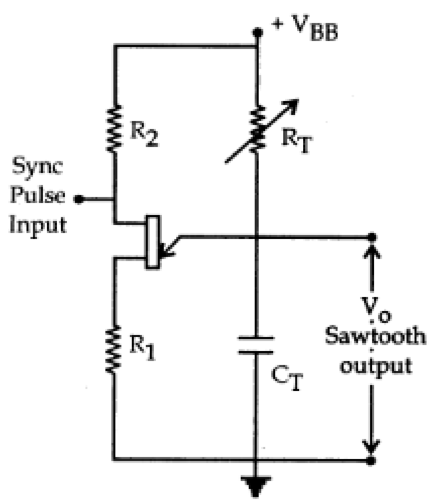




c) Draw the circuit of time base generator and draw the waveform of it w.r.t. trigger signal.

ANS: (circuit 2 mks, explanation- 1 mks, waveforms- 1 mks)

The motion of spot on CRT screen from left to right is called sweep.
The generator which generates signals to move beam spot on screen horizontally is called time base or sweep generator.



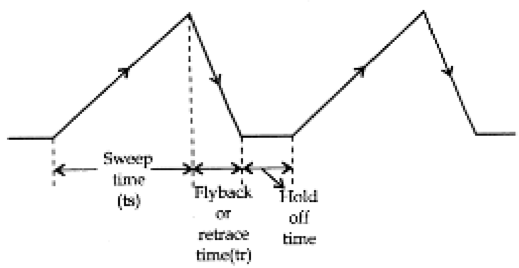
Time base Generator using UJT

Explanation:

The time base convert given signal into sawtooth waveform. As shown in figure which deflect the beam in the horizontal direction.

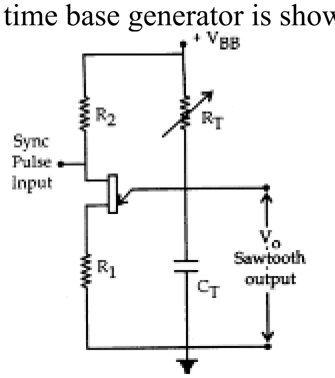
The waveform is divided into two parts i.e. sweep time and retrace time.
During sweep time t_s the beam moves left to right horizontally.

The beam is deflected towards right by increasing amplitude of ramp voltage and the fact that positive voltage attracts the negative electrons.
During retrace time or flyback time T_r the beam returns quickly to the left side of screen.
The control grid is generally "gated OFF" which back out the beam during retrace time and prevent an undesirable retrace pattern from appearing on the screen.
The base generator performs the task of producing such repetitive and synchronized voltage signal.

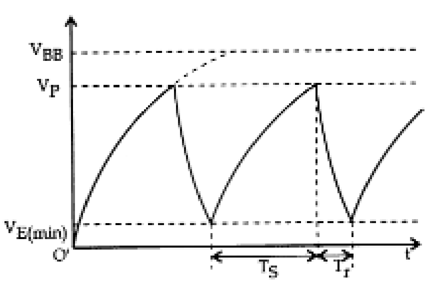


OR

The time base generator is shown in figure.

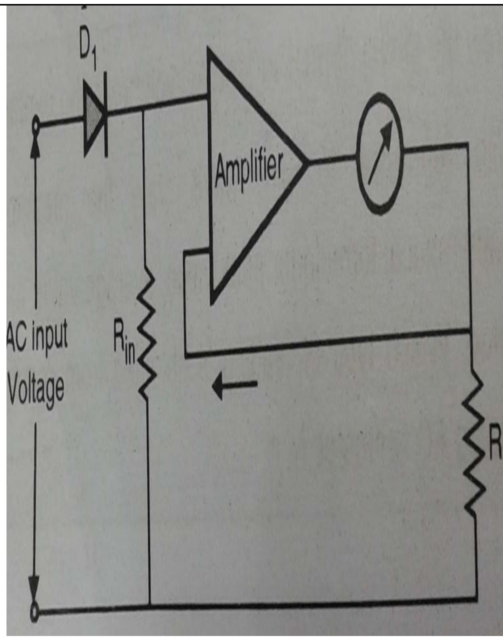
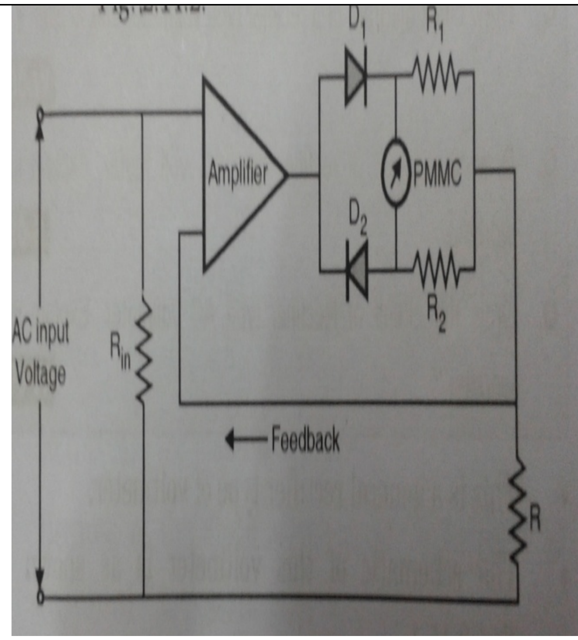


Explanation:
UJT relaxation oscillator is main part of time base generator. It is used to produce sweep.
When power is applied to UJT, initially it is off and the capacitor charge through R_T.
When voltage across capacitor reaches V_P (peak voltage), then UJT turn ON.
Then capacitor discharge rapidly through R_1 and turn OFF UJT.
The cycle of charging and discharging repeats and sawtooth waveform produced as shown in figure.



d) Compare half wave and full wave rectifier type AC voltmeter.

ANS: (each 1M)

Sr. no.	Half wave rectifier	Full wave rectifier
1		
2	Only one diode is used	Two diodes are used
3	Signal is rectified and given to DC amplifier	Signal is first amplify by AC amplifier and then rectified
4	Output from amplifier is fed to PMMC meter	Output from rectifier is fed to PMMC meter

e) Explain the operation of dual slope type DVM with block diagram and waveforms.

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

Operation:

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 voltage (Vin) to integrator.

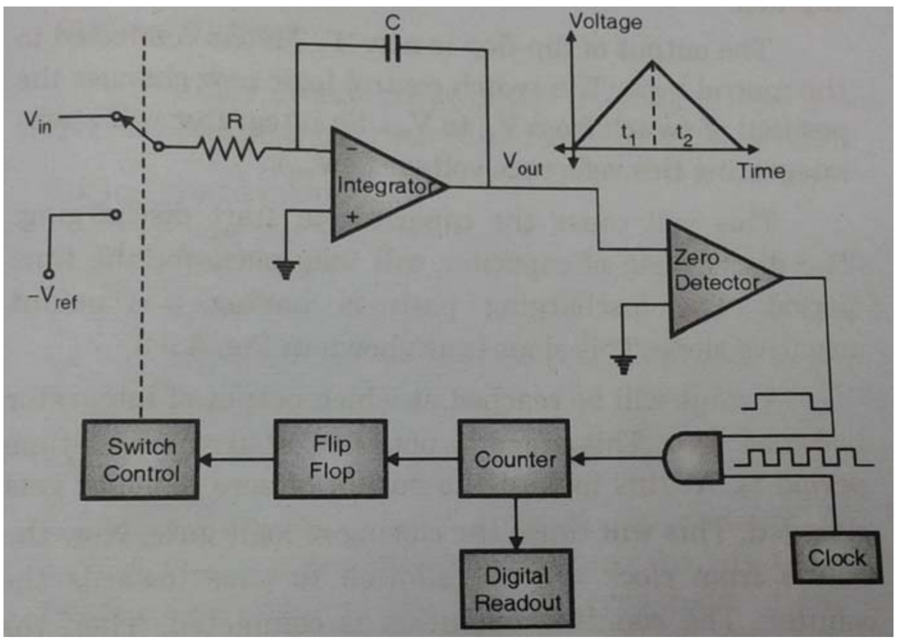
Integrator now starts integrating the input voltage. That means the capacitor starts charging. Because of this the output of integrator changes from zero value. It courses the zero detector (comparator) to change its stage. That means it provided the high signal to the logic gate thus the opening of logic gate takes place.

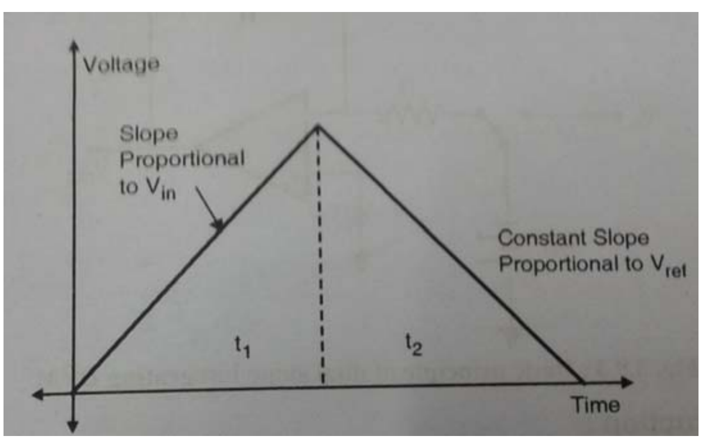
When the logic get is opened, the number of clock pulses are passed to the counter . the counter will count these pulses for a certain time t1. After this time the counter is reached to 999. After this 1 is passed to the flip-flop.

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

This will causes the capacitor to starts to discharging. The discharging of capacitor will take place for the time period . The discharging path is having a constant negative slope. This slope is shown in figure.

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 output of zero detector gets changed. This will causes 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.



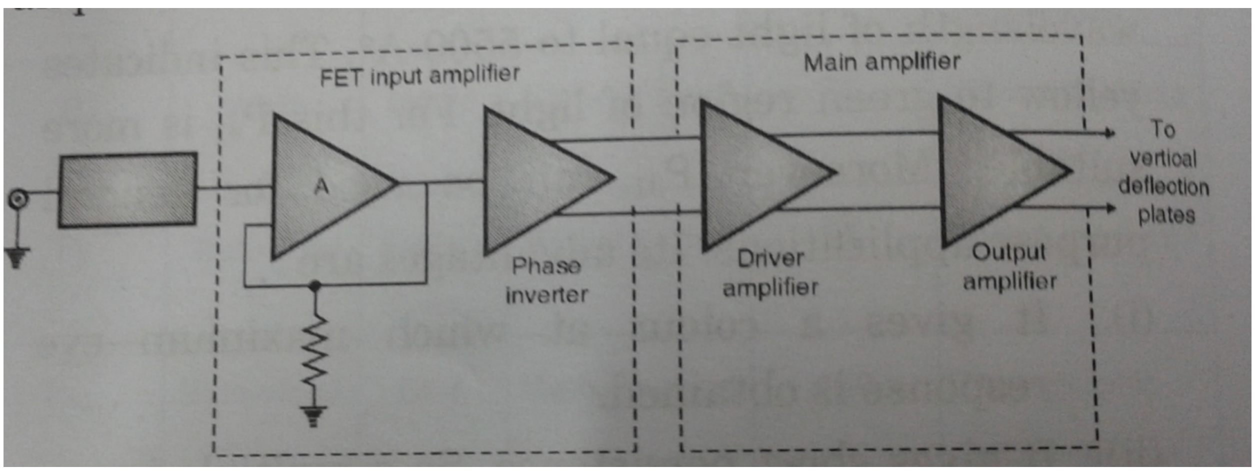


f) Draw the block diagram of the vertical deflection system and explain its operation.

ANS : (block diagram 2M, explanation 2M)

The main function of the vertical deflection system , is to provide an amplified signal of proper level to derive the vertical deflection plates without any distortion. For amplification of the signal to appropriate level , it uses the vertical amplifier. Figure shows the block diagram of the vertical amplifier.

The vertical amplifier consists of a number of stages having fixed overall sensitivity or gain which is expressed in volts / division. Because of fixed gain the amplifier can designed in a manner such that it meets the requirements of stability and bandwidth. The input stage of the preamplifier, consists of an FET source follower. The FET source follower has high input impedance. This impedance is isolated the FET amplifier from the attenuator. The FET source follower input stage is followed by a BJT emitter follower .this is done in order to match the medium impedance of the FET amplifier with low input impedance of the phase inverter. Two antiphase output signals are provided by the FET amplifier, in order to derive the push-pull amplifier output. The push pull out put stage delivers equal signal voltage of opposite polarities to the vertical deflecting plates of the CRT. The advantages of using push-pull stage at the output are better hum cancellation, even harmonic suppression, reduced nonlinear effects because none of the plates are at ground potential.



3. Attempt any four of the following: 16

a) Describe absolute instruments and secondary instruments. Write one example of each one.

ANS: (each 2M with one example)

Absolute instruments:

These instruments read the quantity under measurement indirectly i.e. in terms of deflection, degrees and meter constant. The actual value under measurement can be calculated by using the formula = deflection multiplied by constant of meter.

Examples of these instruments:

1) Tangent galvanometer.
2) Current balance meter.

Secondary instruments:

These instruments read the quantity under measurement directly i.e. if it is ammeter, it reads directly in ampere e.g.

1) The meter is commonly used in lab such as ammeter, voltmeter, wattmeter and energy meter.
2) Secondary instruments are further classified as:
    (a) Depending upon the principle of operation
    (b) Depending upon permissible percentage error.
    (c) Depending upon application.

b) A 1 mA meter movement with an internal resistance of 100 Ω is to be converted into 0-100mA. Calculate the value of shunt resistance.

ANS:(proper calculation 4M)

Im = 1mA, Rm=100Ω, I= 100mA

$$Rsh = \frac{ImRm}{I - Im}$$

$$Rsh = \frac{1 \times 10^{-3} \times 100}{(100 - 1) \times 10^{-3}}$$

$$Rsh = \frac{100}{99}$$

$$Rh = 1.01\Omega$$

c) A basic D'Arsonval movement with a I_{fs} = 50 µA,R_m = 500 Ω is to be converted into 0-10 V voltmeter.
Determine the value of multiplier resistance.

ANS : (proper solution -4M)

Ifs = 50µA, Rm= 500Ω, Vin= 10 Volts

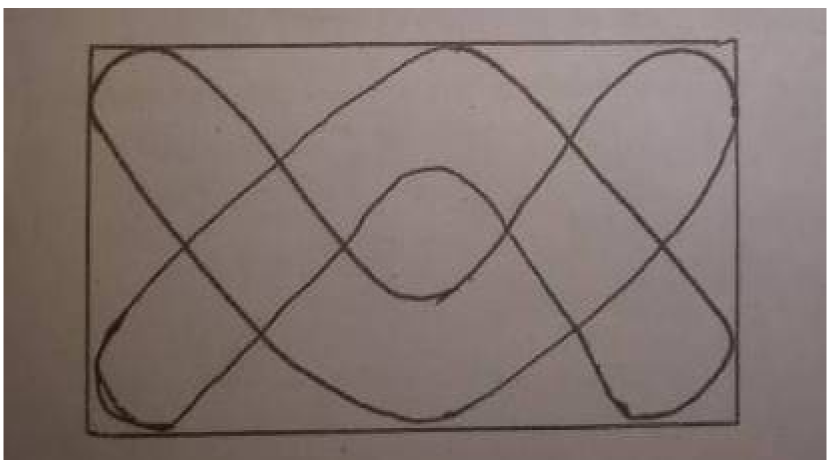
$$Rs = \frac{Vm}{Ifs} - Rm$$

$$Rs = \frac{10}{50 \times 10^{-6}} - 500$$

$$Rs = 199.5K\Omega$$

d) The following lissajeous pattern is observed in the CRO when channel -2 frequency is 1200Hz.Calculate the channel – 1 frequency.

ANS: (proper calculation- 4 mks)



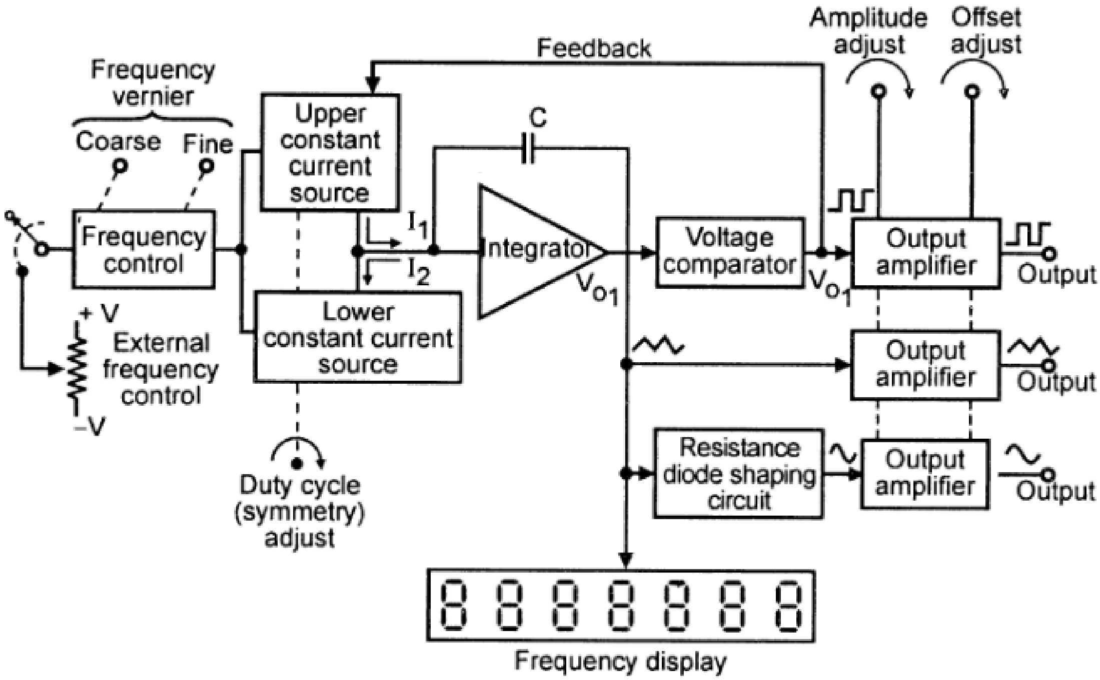
Channel 1 Frequency/ Channel 2 frequency = 3/2

Channel 1 frequency = 3/2 * 1200

=1800 Hz (4 mks)

e) Draw the block diagram of function generator and explain how sine wave is generated.

ANS: (Block diagram- 3 mks, sine wave generation – 1 mks)



Explanation-For generation of sinewave , out of the three knobs- sine, square and triangular , the sine knob is pressed, output is adjusted for required frequency and amplitude using frequency and amplitude knobs. (1 mks)

f) Write the applications of :
(1) Function generator
(2) Video pattern generator
(3) AF signal generator and
(4) Pulse generator.

ANS: (each for 1M)

Applications:

1) Function generator:

i) As trouble shooting tool to different analog and digital circuits.
ii) As a source of alignment of different receiver.
iii) If rise time of square wave is significantly low, such square wave is used to test the amplifier frequency response (square wave testing).
iv) Well synchronized arbitrary waveform like burst, sweep, cardiac, saw tooth, AM, FM, FSK, noise etc .

2) Video pattern generator:

i) A pattern generator is a device which can generate video signals that can be fed to a TV or video monitor. The pattern consist of geometrical figures such as circles, ellipses, horizontal/ vertical lines and bars, checker board, dots etc.

3) AF signal generator:

i) It can be used for testing of radio transmitters and radio receivers.

ii) It can be used as a power source for the measurement of gain and amplitude.

4) Pulse generator:

i) The pulse generator is used as a measuring device in combination with the oscilloscope.

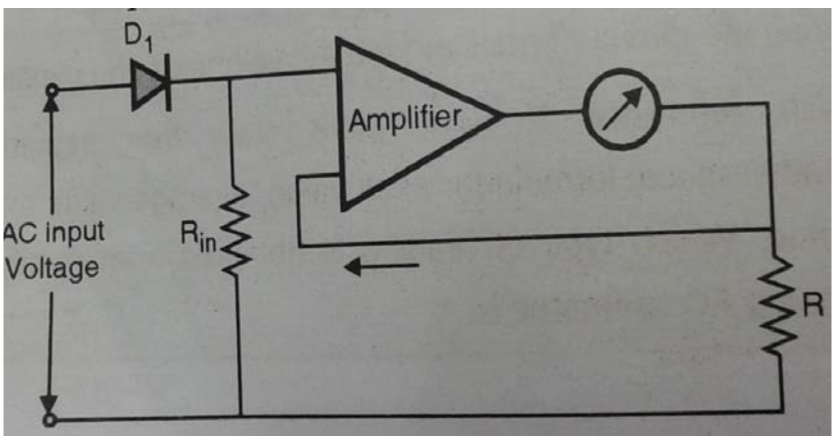
ii) To synchronize with external circuits trigger output, pulses are available.

iii) The generator can be operated as free running generator.

4. Attempt any four of the following: 16

a) Draw the circuit of the rectifier type AC voltmeter (half-wave) and write the use of diodes in it.

ANS: (circuit diagram 3M, use of diode 1M)



Use of diode- A single diode is used to do the ratification.

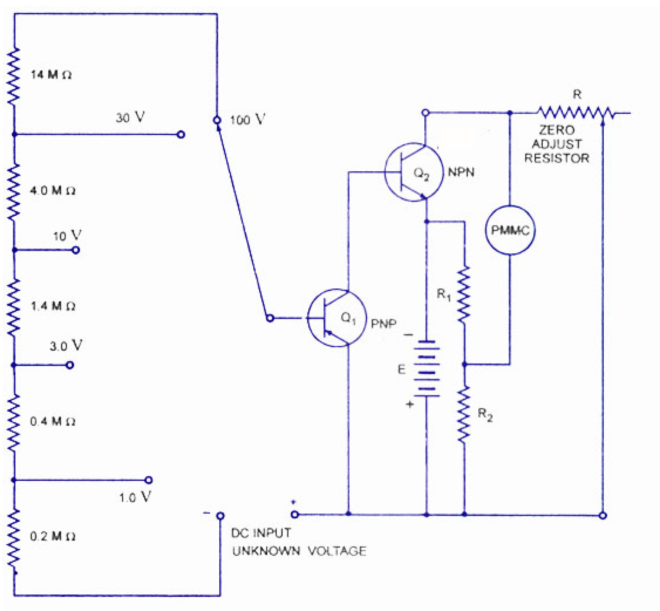
b) What are the advantages of DVM over electric voltmeter?
Draw the circuit of transistor voltmeter.

ANS: **(any four Advantages- 2M, circuit diagram 2M)**

Advantages:

1) In case of digital volt meter the output signals is available in the form of discrete numerical. Where as in analog voltmeter, output is made available by using pointer deflection on a continuous scale.
2) It has high speed.
3) Digital voltmeter can be programmed. So controlling by computer is achieved.
4) It has automatic range selector.
5) It has overload indication. This is indicated by an additional leading digit. Usually this digit is 1.

6) Accuracy can be made as high as ±0.005 percent.
7) It provides a good stability.
8) It gives better resolution. For example can be read on 1 volt input range.
9) The internal calibration does not depend on the measuring circuit
10) Output signal can be recorded.
11) By using a suitable transducer the quantities such as temperature, pressure, etc. can also be measured.



Direct Coupled Amplifier DC Voltmeter Using Cascaded Transistors

c) Compare analog CRO with digital storage oscilloscope (DSO).

Ans:-(relevant 4 points- 4 mks)

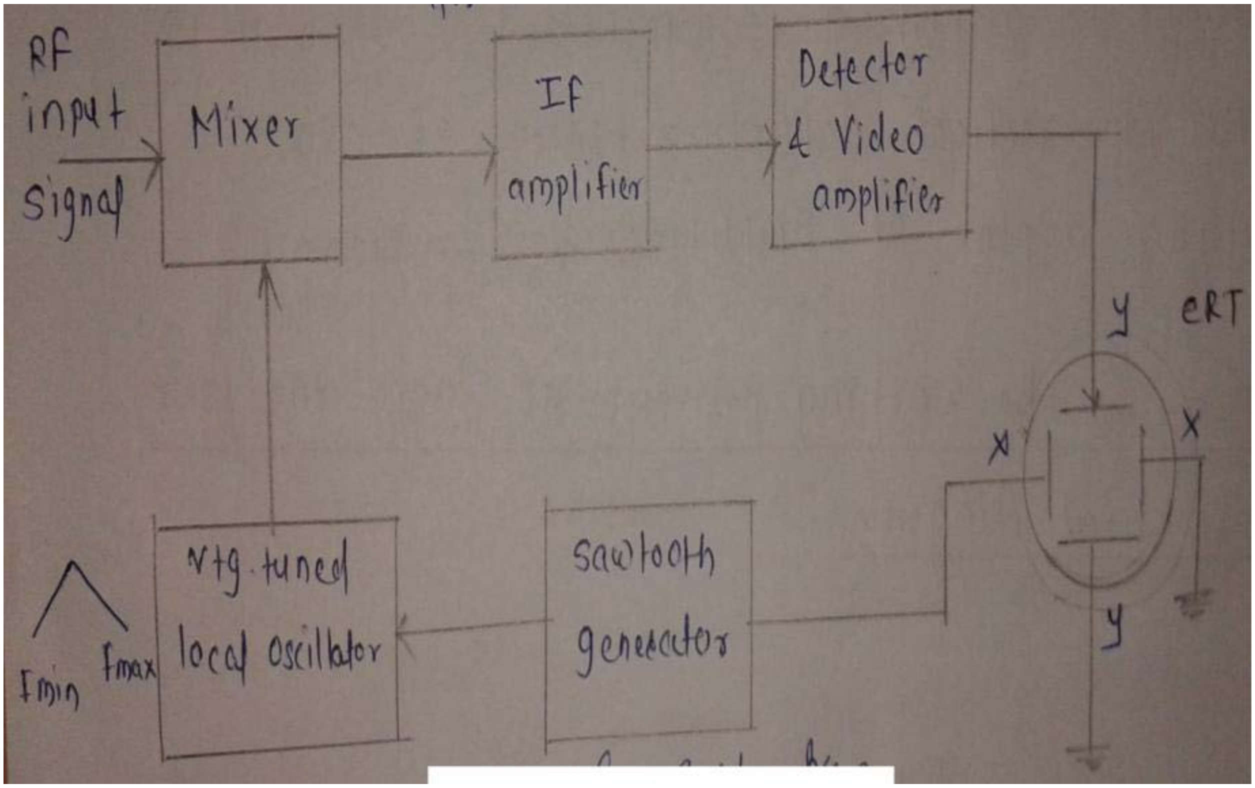
Sr No	Analog CRO	DSO
1	High bandwidth	Less bandwidth due to aliasing effect
2	High writing speed about 15 GHz	Limited speed
3	No memory	Has memory for storage

4	high performance converter	Low performance
5.	Costlier CRT	Cheaper CRT
6	Low resolution	High resolution
7	the time base is generated by a ramp circuit, so less stability	The time base in a digital storage oscilloscope is generated by a crystal clock so that it is more accurate and stable than an analog oscilloscope
8	Less storage time.	The digital oscilloscope is capable of an infinite storage time, using its digital memory.

d) Draw the block diagram of spectrum analyzer and draw the output shown on its screen.

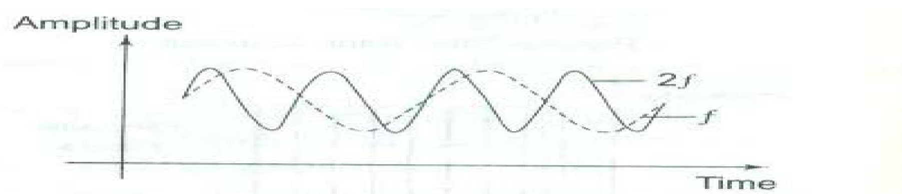
ANS : (Block diagram 2M, output shown 2M)

Block diagram:

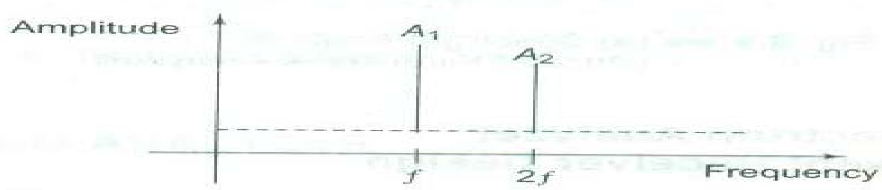


OR
(Any other relevant diagram shall be considered)

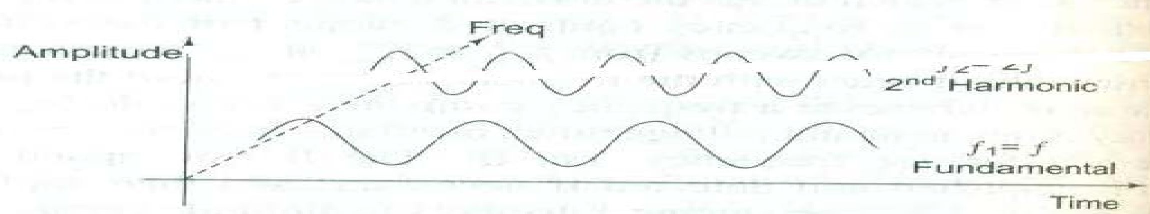
Output:



Test Wave Seen on Ordinary CRO



Display on the Spectrum CRO

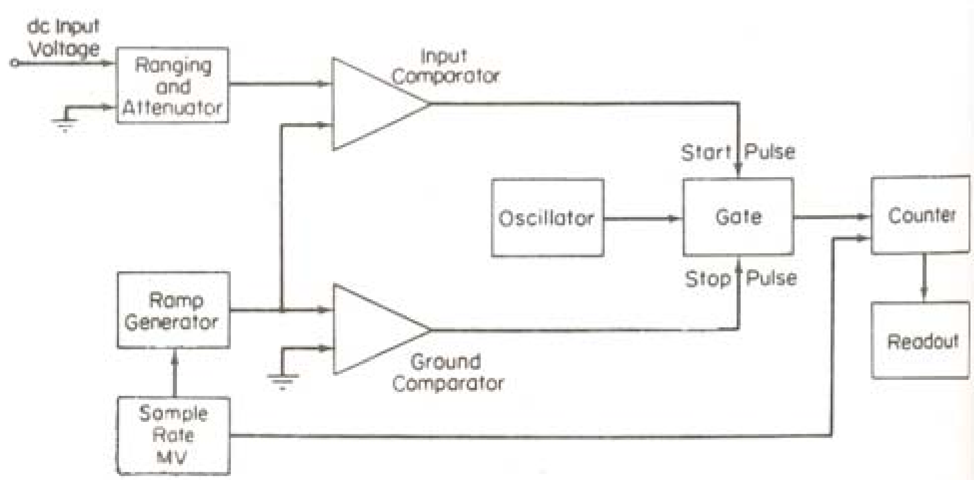


Test Waveform as Seen on X-Axis (Time) and Z-Axis (Frequency)

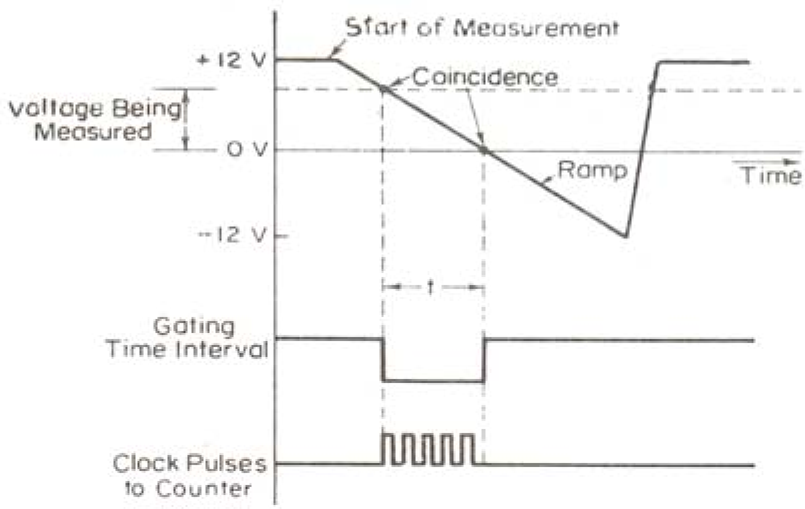
e) Draw ramp type DVM block diagram and draw the necessary waveforms.

ANS: (Block diagram 2M, waveforms 2M)

Block diagram:



Waveforms-



Q.5 : Attempt any Four of the following **16M**

a) Draw the block diagram of digital storage oscilloscope.

Ans. (Proper block diagram- 4 mks) **(4M)**

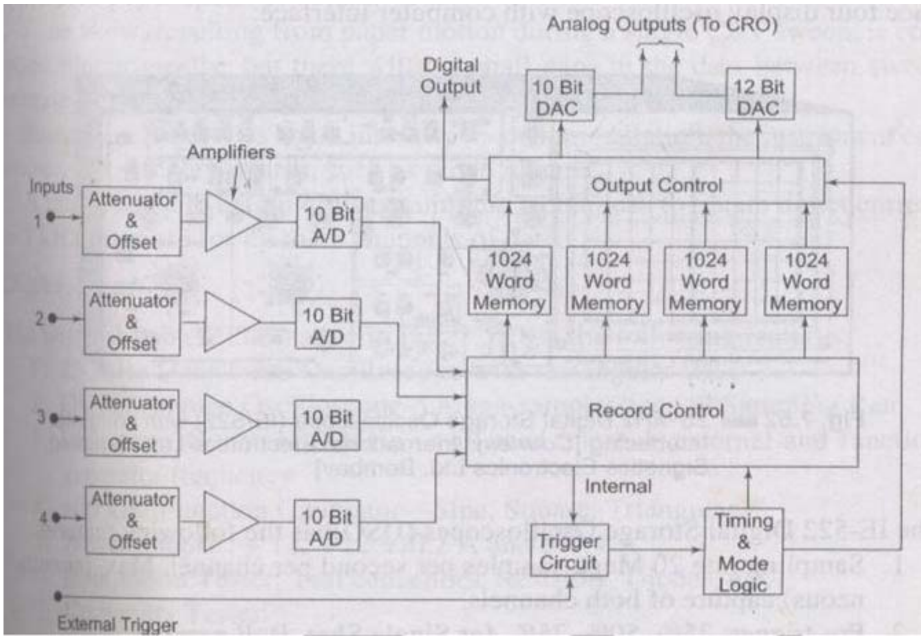


Fig. Block diagram of Digital Storage Oscilloscope

b) Draw the construction diagram of CRT . Write two material used for display of CRT screen.

Ans : (Construction- 2 mks, any 2 materials- 2 mks)

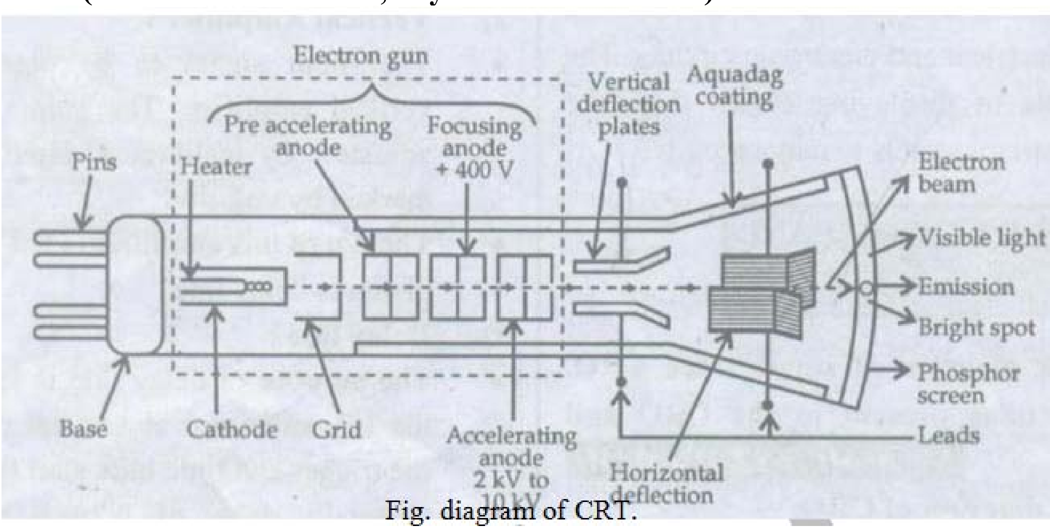


Fig. diagram of CRT.

Material used for display of CRT screen.

1. Phosphor
2. Zinc sulfide
3. Cadmium sulfide

C) Write four specifications of AF signal generator .

Ans (Any four points- 4 mks)

1. Frequency range: X1range ($10H_{z}$- -100 H_z), X10 , X100 , X1K , X10K

2. Frequency Accuracy ±(3%+1 H_z)

3. Sinewave characteristics:

4. Output voltage: 5 volts rms or more

5. Frequency characteristics: $10H_z$- -1MH_z +0.5 dB

6. Output impedance : Approximately 600Ω

7. Input impedance :Approximately 150KΩ

d) Draw the block diagram of logic analyzer . Draw the waveform on it with different types/ modes of display of logic analyzer .

Ans : (Block diagram- 2 mks, waveforms- 2 mks)

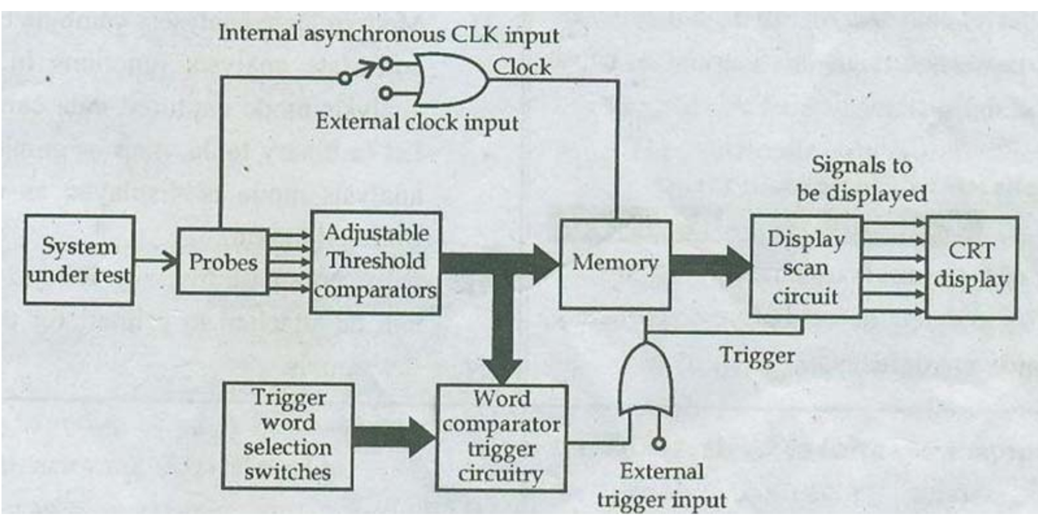
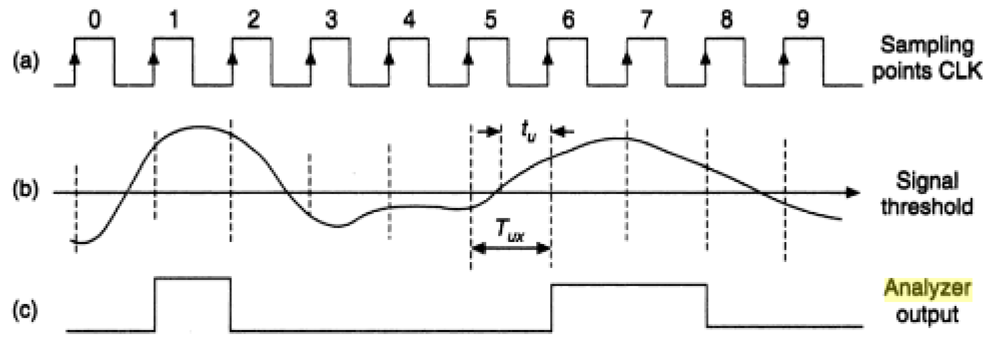


Fig. block diagram of logic analyzer

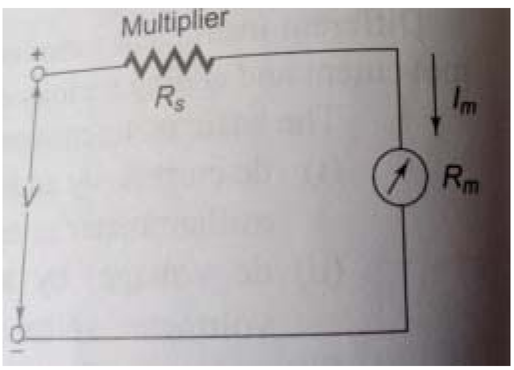
Waveform on logic analyzer with different types/ modes of display.



e. Derive the equation of series resistance in DC voltmeter using basic D'Arsonval movement.

Ans :

Circuit diagram of DC voltmeter (1M)



Derivation (3M)

A basic D' arrsonal movement can be converted into dc voltmeter by adding a series resistor known as multiplier as shown in fig. The function of this multiplier is to limit the current through the movement so that current does not exceed the full scale deflection value

The value of multiplier required is calculated as follows

Im = Full scale deflection current of the movement

Rm = internal resistance of movement

Rs = multiplier resistance

V= Full range voltage of the instrument

From the circuit diagram

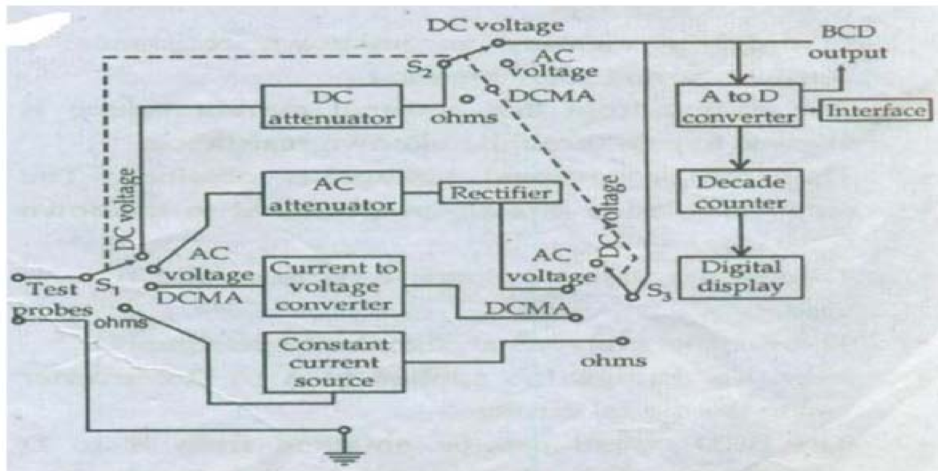
V = Im (Rs + Rm)

Rs=$\frac{V-ImRm}{Im}$ =$\frac{V}{Im}$ –Rm

Therefore Rs= $\frac{V}{Im}$ –Rm

f. Draw the block diagram of Digital multimeter.

Ans: (block diagram-4 mks)



Block Diagram of Digital Multimeter

Q. 6 Attempt any Four of the following 16M

a) Compare analog and digital instruments .

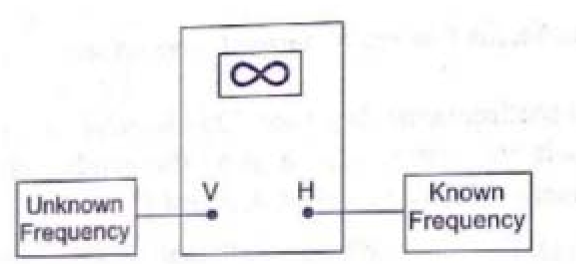
Ans : (Any Four Points- 4 mks)

Sr. No.	Parameter	Analog Instrument	Digital Instrument
1	Principle	The instrument that displays analog signals is called as on analog instrument.	The instrument that displays digital signals is called as a digital instrument.
2	Accuracy	The accuracy is less.	The accuracy is more.
3	Resolution	The resolution is less	The resolution is more.
4	Power	Requires more power.	Requires less power.
5	Cost	Analog instruments are cheap.	Digital instruments are expensive.
6	Observational errors	Analog instruments have considerable observational errors.	Digital instruments are absolutely free from the observational errors.
7	Examples	PMMC instrument, Potentiometer, DC ammeter, DC voltmeter, etc.	Logical analyzer, signature analyzer, computers, microprocessor based instruments, etc.

b) Explain different methods to measure phase shift between two signals.

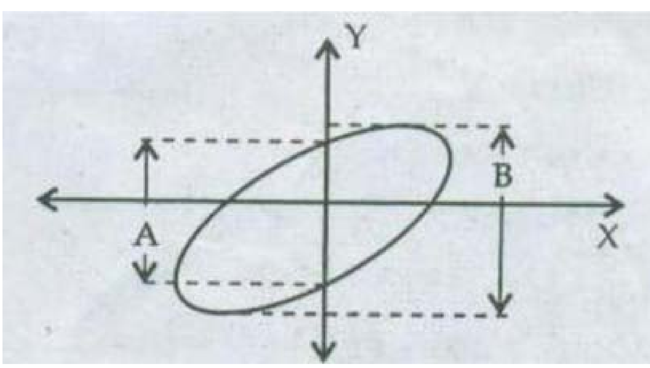
Ans : Proper explanation-4 mks

Phase measurement of Lissajous figures:



- 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,

  $\Theta = \sin^{-1} (A/B)$



A. The Lissajous pattern will be an ellipse if the sine waves of equal frequency but phase shift between 0^0 and 90^0 are applied to the two channels of CRO. The Lissajous pattern will be as shown below-

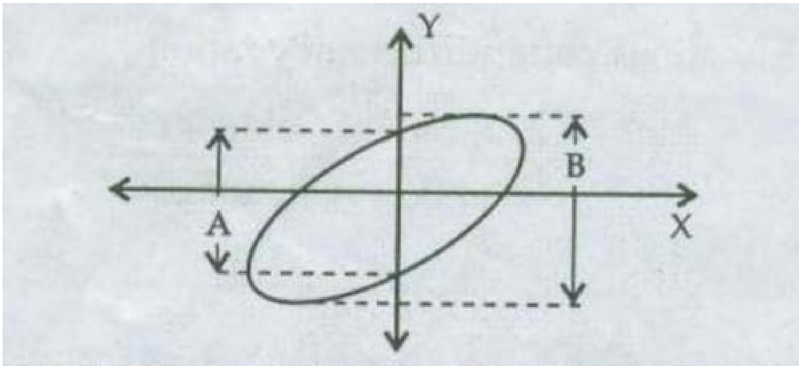
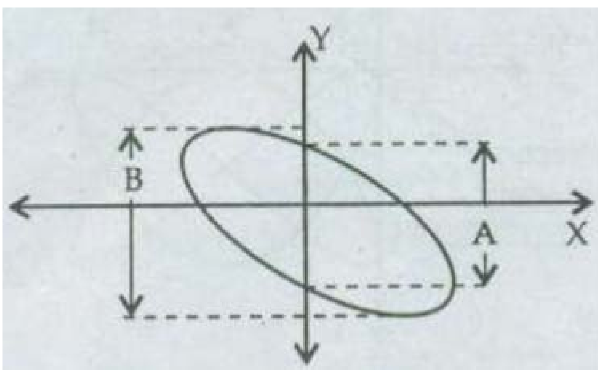
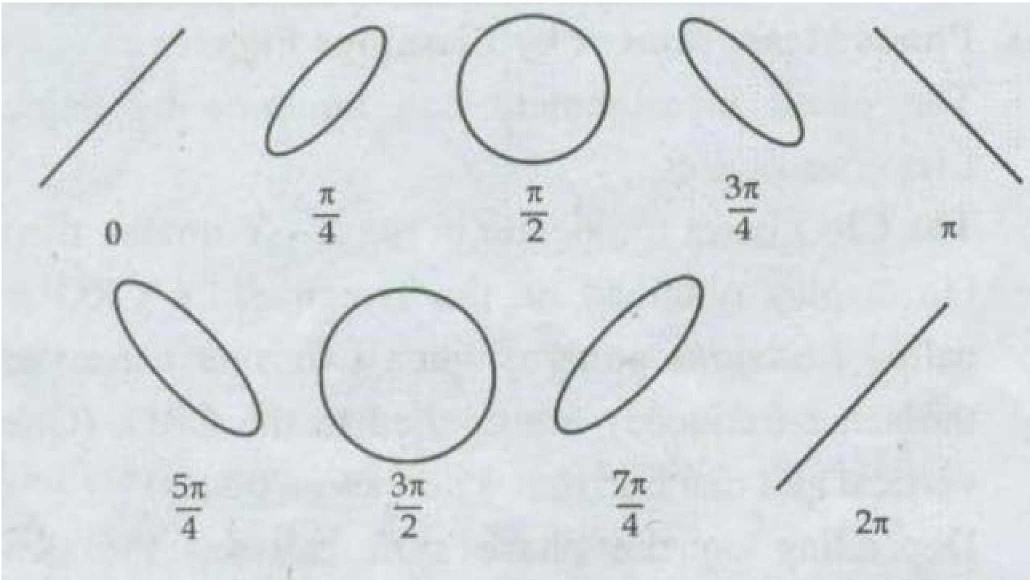


Fig. Lissajous pattern for ellipse for $0° < \theta < 90°$

B. For the phase difference above 90^0 and less than 180^0, the ellipse appears as shown



C. Different Lissajous figure for phase difference 0^0, 45^0, 90^0, 135^0, 180^0, 225^0, 270^0, 315^0, 360^0 are shown below respectively



Hence their Lissajous Pattern will be as shown below.

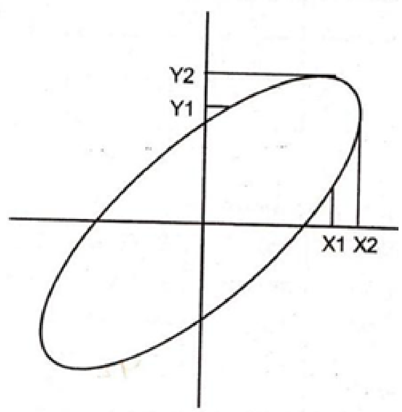


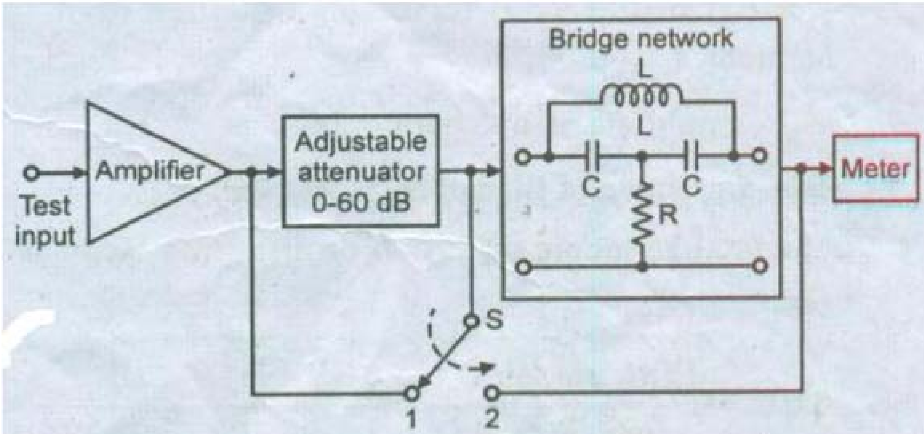
Fig. 7.1

Calculate phase difference by using formula

$\phi = \sin^{-1}(Y1/Y2) = \sin^{-1}(X1/X2)$

c) Explain working of distortion factor meter with block diagram

Ans : **(2M)**



Working :

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.

d) Compare accuracy and precision .

Ans: (Any four points) **4M**

Parameter	Accuracy	Precision
Definition	The degree of conformity and correctness of something when compared to a true or absolute value.	A state of strict exactness — how often something is strictly exact.
Measurements	Single factor or measurement	Multiple measurements or factors are needed
Relationship	Something can be accurate on occasion as a fluke. For something to be consistently and reliably accurate, it must also be precise.	Results can be precise without being accurate. Alternatively, results can be precise AND accurate.
Uses	Physics, chemistry, engineering, statistics, and so on.	Physics, chemistry, engineering, statistics, and so on.

e) Write four specifications of analog multimeter.

Ans.(Any four points) **4M**

Parameter	Range
DC volts	.1,.5,2.5,10,50,250,1000,3% full scale reading
Ac volts	10,50,250,1KV, 4% full scale readin
Dc current	50uA,2.5mA,25mA,250mA,10A 3%full scale readin
Resistance	X1,x10,X100,X1K,X10K
Transistor h_{FE}	ICEO 150 uA,1.5mA,15mA,150mA

f) Draw the block diagram of digital frequency meter. Which is the counting signal and gating signal in it with 1) Frequency measurement mode 2) Time measurement mode

Ans.(block diagram- 2 mks, each mode-1 mks) **(4M)**

Fig. Block diagram of Digital Frequency Meter

1) Frequency measurement mode-
Counting signal: The signal whose frequency is to be measured.

Gating signal: This determines the length of time during which the counters are allowed to totalize the pulses separated by the time period of the original input signal.

2) Time measurement mode-
Counting signal: The number of pulses which occur during one period of the unknown signal are counted and displayed by the decade counting assemblies.

Gating signal: The gating signal is derived from the unknown input signal which now controls the opening and closing of the main gate.