



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.
-

Q1) Attempt any SIX:-

12M

(a) Explain absolute and secondary instruments.

Ans:- . (1 mark for each definition)

_measurement in terms of physical constants of the instruments.

Examples –Tangent Galvanometer, Rayleigh's current Balance.

Secondary Instruments: –These instruments are so constructed that the quantity being measured can only be measured by observing the output indicated by the instrument.

Examples –voltmeter, ammeter.

(b) State principle of piezoelectric transducer.

Ans:–

Principle:-

02M

Principle of piezoelectric transducer: Certain solid materials (crystals) when deformed generate electric charges within them. This effect is reversible; i.e., if a charge is applied, then material mechanically deforms.



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Model Answer

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(c) Write the classification of temperature transducer.

Ans:—

02M

Classification of temperature transducer:-

A) Non-Electrical Methods

- i) Bimetal
- ii) Liquid in Glass
- iii) Pressure Thermometer

B) Electrical Methods

- i) Thermo Resistive
 - a) Resistance Thermometer(RTD)
 - b) Thermistor
- ii) Thermoelectric
 - a) Thermocouple

(d) State four applications of CRO. (ANY FOUR POINTS)

Ans: —

APPLICATION:-

½ M each

- 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 to test AF circuit for different distortion.
- 4) It is used to check faulty components.
- 5) It is used to check signals at radio and TV receiver.
- 6) It is used to check radiation pattern generated by antenna.



(e) Draw the schematic diagram of Instrumentation system.

Ans:- Diagram 02 M

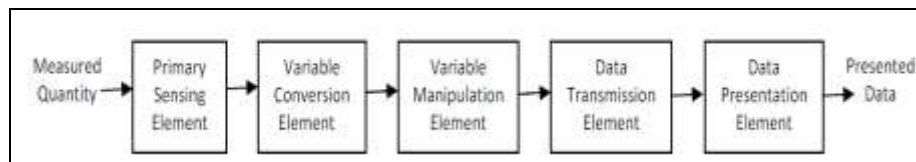


Figure:- Schematic diagram of instrumentation system.

(f) State the need of signal generator. Also compare RF and AF type signal.

Ans:- (1 mark for signal generator & 1 mark for comparison)

Note: Any relevant points should consider

Need of signal generator:-

An oscillator (sine wave generator) is one of the most basic electronic instruments. Generation of signals (AF or RF) is an important fact of electronic trouble shooting & development.

The signal generator is used to provide known test conditions for the performance & evolution of various electronic system & for replacing missing signals in the systems being analyzed for repair.

Comparison:-



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RADIO FREQUENCY (RF)	AUDIO FREQUENCY(AF)
Frequency range 30kHz- 100MHz	Frequency range 0Hz -3MHz
Mostly LC oscillators	Mostly RC oscillators
For testing of TV, radio receiver & antenna	General purpose frequency testing experiments.

(g) Give classification of transducers.

Ans:-Transducer classification (any four criteria)

02M

- Primary & secondary transducer.
- Active & passive transducer.
- Analog & Digital transducer.
- Transducer & inverse transducer.
- Electrical & mechanical transducer.

(h) State function of Delay line in CRO and give its types.

Ans:- (1 mark for delay line & 1 mark for type)

Function of delay line :-

To allow the generator to observe the leading edge of the signal waveform, the signal drive for the vertical CRT plates must therefore be delayed by at least the same amount of time. This is the function of delay line.

Its types are:-

- Lumped parameter delay line.
- Distributed parameter delay line

(B) ATTEMPT ANY TWO:-

8 MARKS

(a) Explain primary and secondary transducers with the help of suitable diagram.

Ans:- (Fig 2 m & explanation 2 m)

Explanation:-

Primary Transducer:- Primary transducers are detectors which sense a physical phenomenon. The transducer which directly comes in contact with measuring & acts as a sensor to sense or detect the physical quantity is called primary transducers. As shown in Fig the Bourdon tube comes in contact with input pressure directly hence it act as a primary transducer, which convert the pressure into proportional displacement of its free end.

Secondary Transducer:- The displacement given by the Bourdon tube is now applied to the core of the LVDT to convert this displacement into proportional electrical quantity(voltage). Hence the LVDT is called as secondary transducer.

Diagram:-

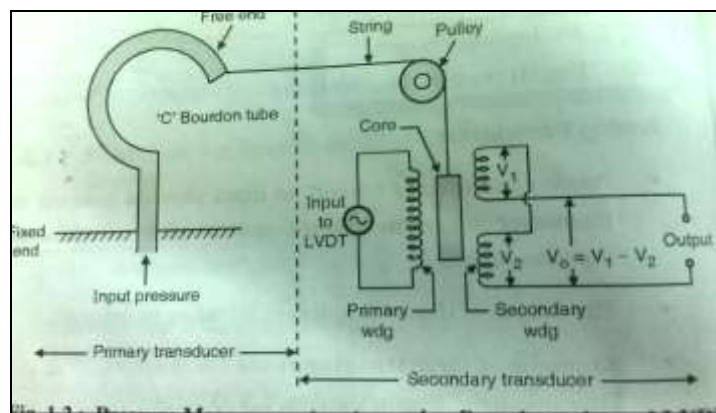


Figure: Diagram of Primary & Secondary Transducer



(b) The expected value of voltage across resistor is 50 V. However the measurement give 49V. Calculate (i) absolute error (ii) percentage (%) error.

Ans:- (2 m+ 2 m)

Solution:-

i) Absolute error= Measured value –True

$$= 49 - 50 = -1$$

ii) Percentage (%) error = Absolute error / True value * 100

$$= 1/50 * 100$$

$$= 2\%$$

(c) Draw the constructional diagram for PMMC instrument neatly and label it. Also state the torque equation

Ans :- .(Fig 2 m & equation 2 m)

Diagram:-

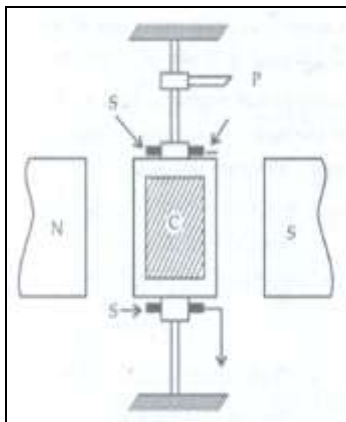


Figure:- Constructional diagram of PMMC Instrument



EQUATION:-

The torque equation is

Deflecting torque

$$T_d = B * A * I * N$$

Where, T=Torque (Newton-meter)

B= Flux density in the air gap (Webbers/square meter)

A =Effective coil area (square meter)

I =Current in the movable coil (amperes)

N = Turns of wire on the coil.

Controlling Torque:

$$T_c = \theta * C$$

Q.2)ATTEMPT ANY FOUR:-

16MARKS

(a)Draw the block diagram of time base generator and state its need.

Ans :- (Fig 2 m &explanation 2 m)

Need of Time base generator:-

- The main purpose of time base generator is to convert given input signal into saw tooth waveform, which will deflect the beam in the horizontal direction.
- It has two modes i.e. sweep mode and fly back mode.
- During sweep time T_S the beam moves left to right across the CRT
- 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 fly back time T_r the beam returns quickly to the left side of screen.

- The control grid is generally gated OFF which black out the beam during retrace time and prevent an undesirable retrace pattern from appearing on the screen

Diagram:-

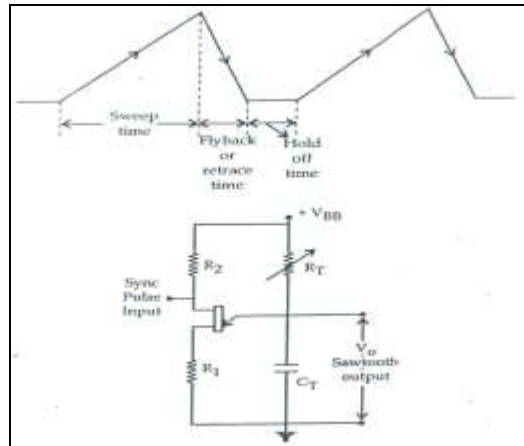


Figure:- Diagram of Time Base generator

(b) Write the working principle of RTD. How the temperatures change is measured using RTD?

Ans - (Fig 2 m & explanation 2 m)

Diagram:-

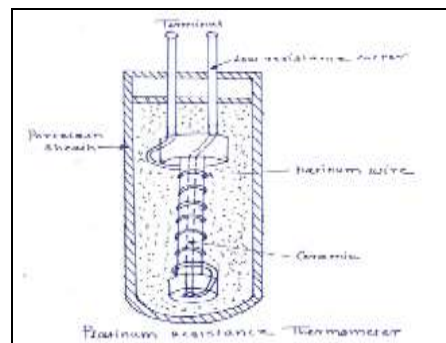


Figure:- RTD



Explanation:-

RTD measures temperature using platinum, nickel, copper wire whose resistance changes with change in temperature. Resistance thermometer works on the principle of positive temperature coefficient of resistance i.e. as temperature increases, resistance offered by thermometer also increases. The resistance of wire at t_0 °C is given by

$R_t = R_0 (1 + \alpha_0 t)$ Where R_t = Resistance at t_0 °C.

R_0 = Resistance at 0°C.

α_0 = Resistance temperature coefficient

t = Change in temperature

Figure shows the modern platinum resistance thermometer. It consists of pure, well annealed platinum wire wound on thin strip of mica or ceramic and placed in porcelain sheath. Free ends of platinum wire are attached to long lead of low resistance copper wire.

To measure the change in Resistance Bridge network is used. The resistance thermometer is connected to one of the arm of Wheatstone bridge circuit. When resistance thermometer is subjected to temperature variation, the Wheatstone bridge gets unbalanced. The galvanometer deflection can be directly calibrated to give temperature. The unknown temperature T is given as

$$T = R_t - R_0$$

$$R_{100} - R_0$$

Where R_t = Resistance of wire at temperature t .

R_0 = Resistance of wire at 0°C.

R_{100} = Resistance of wire at 100°C.

Platinum is especially suited for RTD as it withstands high temperature while maintaining excellent stability. Tungsten has a relatively high sensitivity, but it is used for high temperature applications as it is extremely brittle and difficult to work. Copper is occasionally an economical alternative up to temperature 1200°C

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Model Answer

c) Draw the block diagram of function generator. State its four applications.

Ans:-.: (Fig 2 m &application 2 m)

Diagram:-

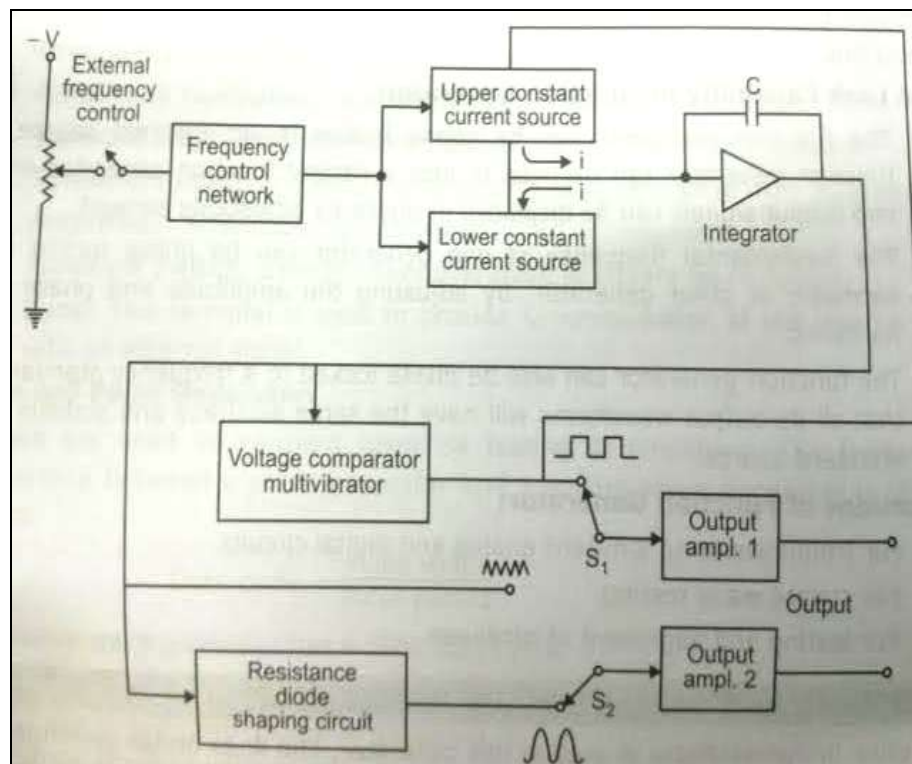


Figure:- Block diagram of function generator

Applications of Function Generator:-

1. For troubleshooting different analog & digital circuits.
2. For square wave testing.
3. For triangular wave testing.
4. For testing & alignment.

d) With neat schematic diagram illustrate the working principle of Digital Frequency Meter.

Ans –: (Fig 2 m & explanation 2 m)

Diagram:-

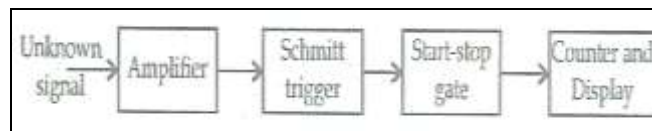


Figure:- Block diagram of Digital Frequency Meter

Explantaion:-

Digital frequency meter:

- 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.

e) Draw neat diagram of Electromagnetic flow meter and explain its working principle.

Ans:- (Fig 2 m & explanation 2 m)

Diagram:-

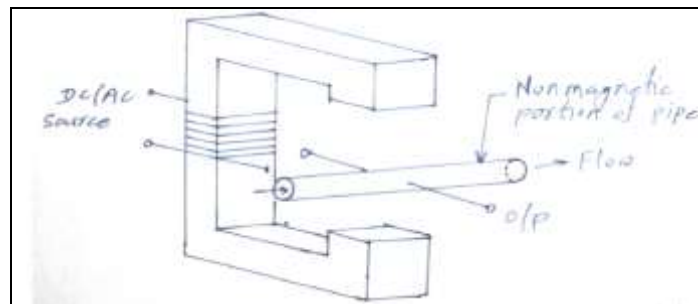


Figure:- Electromagnetic flow meter

Working principle :-

The operation of this type of flowmeter is based on Faraday's law of electromagnetic induction. The law states that whenever the conductor moves through a magnetic field, an emf is induced in the conductor proportional to the relative velocity between the conductor & the magnetic field.

It consists of a pipe, short section of which is subjected to a transverse magnetic field. The conductive fluid is passed through this pipe. As fluid passes, its motion relative to field produces an emf proportional to velocity according to Faraday's law.



This output emf is collected by the electrodes (kept at points of maximum potential difference) and is given to external circuitry.

(f) Calculate the values for multipliers for internal resistance $100\ \Omega$ of meter, full scale deflection current $50\ \text{mA}$ and voltage range are $0\text{-}10\text{V}$, $0\text{-}100\text{V}$ and $0\text{-}200\text{V}$.

Ans: –

Solution:-

Given :- $I_{Fsd} = 50\text{mA}$ $R_m = 100\Omega$ $R1=?$ $R2=?$ $R3=?$

1) For $0\text{-}10\ \text{V}$ Range

$$R_T = V_{\text{max}} / I_{Fsd}$$

$$= 10\ \text{V} / 50\ \text{mA}$$

$$= 200\ \Omega$$

$$R_3 = R_T - R_m$$

$$= 200\Omega - 100\Omega$$

$$\mathbf{R_3 = 100\Omega}$$

2) For $0\text{-}100\ \text{V}$ Range

$$R_T = V_{\text{max}} / I_{Fsd}$$

$$= 100\ \Omega / 50\ \text{mA}$$

$$= 2000\ \Omega = 2\text{K}\ \Omega$$

$$\mathbf{R_2 = R_T - (R_m + R_3)}$$

$$= 2\text{K}\Omega - (100\Omega + 100\Omega)$$

$$\mathbf{R_2 = 1.8\text{K}\Omega}$$

(3) For $0\text{-}200\ \text{V}$ Range

$$R_T = V_{\max} / I_{Fsd}$$

$$= 200 \text{ V} / 50 \text{ mA}$$

$$= 4 \text{ K}\Omega$$

$$R_1 = R_T - (R_m + R_3 + R_2)$$

$$= 4 \text{ K}\Omega - (100\Omega + 100\Omega + 1.8 \text{ K}\Omega)$$

$$R_1 = 2 \text{ K}\Omega$$

Q.3 Attempt any FOUR of the following :

16 M

(a) Draw the circuit of basic DC ammeter. Derive equation for shunt resistance.

Ans:(Diagram 2 M, Equation 2 M)

Diagram:

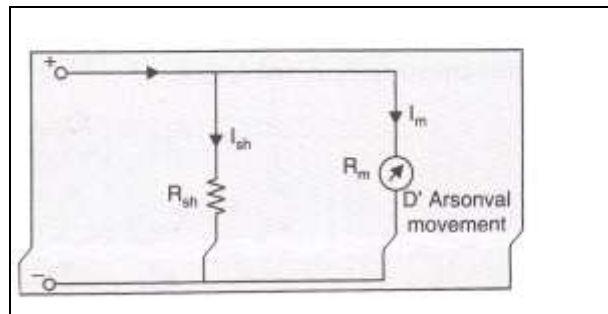


Figure: Circuit of basic DC ammeter

Equation:

Where , R_m =Internal resistance

R_{sh} = Resistance of the shunt

I_m = Full scale deflection current

I_{sh} = Shunt current



I=current to be measured

$$V_{\text{shunt}} = V_{\text{movement}}$$

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

and

$$R_{\text{sh}} = I_m R_m / I_{\text{sh}}$$

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

$$R_{\text{sh}} = \frac{I_m R_m}{I - I_m}$$

Rearranging the above equation we get,

$$\frac{I}{I_m} = 1 + \frac{R_m}{R_{\text{sh}}}$$

The ratio of total current to the movement current is known as multiplying power of shunt.

$$m = \frac{I}{I_m} = 1 + \frac{R_m}{R_{\text{sh}}}$$

$$R_{\text{sh}} = \frac{R_m}{(m-1)}$$

b) Draw the neat block diagram of wave analyzer and state the function of each block.

Ans: (Diagram 2 M Function 2 m)

Diagram:-

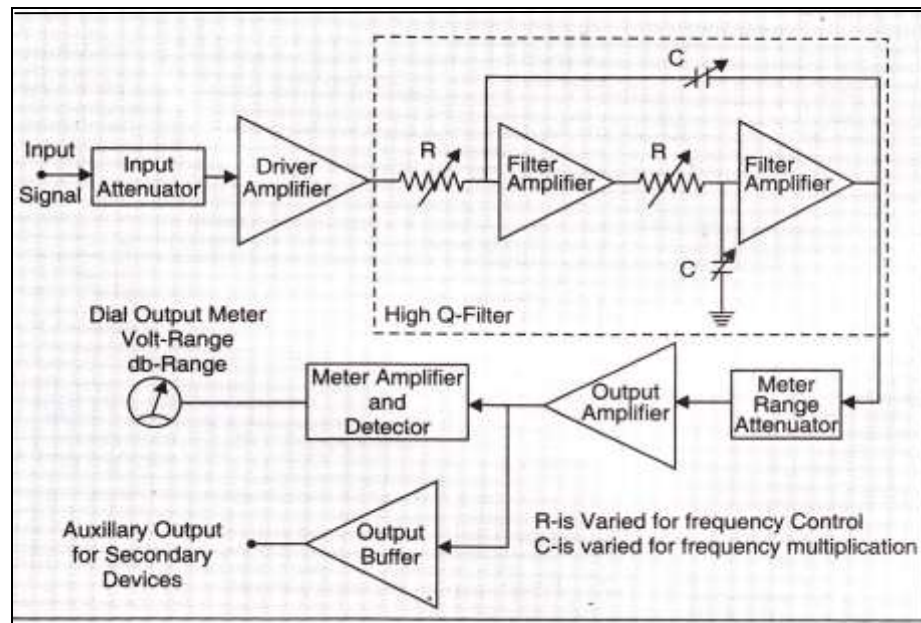


Figure: Block diagram of Wave analyzer

Functions:-

- The wave analyzer consists of a very narrow pass-band filter section which can be turned to a particular frequency within the Audible frequency range (20 Hz-20 KHz).
- The complete 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 attenuated input signal to a high Q active filter.
- This a high Q active filter is a low pass filter which allows the frequency which is selected to pass and reject 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 consists of a cascaded RC resonant circuit and amplifiers.
- The capacitors 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 a frequency selective voltmeter.
- The entire AF range is covered in decade steps 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 device such as Recorders or Electronics counters
- The meter has several voltage ranges as well as decibel scales marked on it.

c) Compare analog and digital multi meter on basis of (i) Resolution (ii)Function available and(iii)Power Consumption.

Ans: Resolution 1 m, Function available 1 ½, Power Consumption 1 ½

Comparison :-

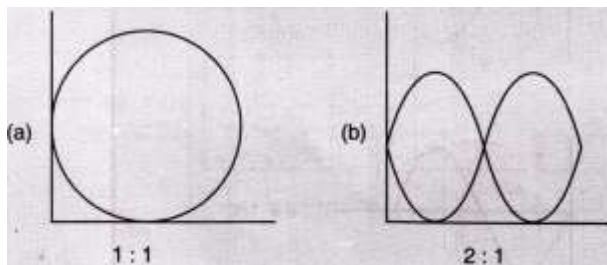
Parameters	Analog multi meter	Digital multi meter
i)Resolution	Less	more
ii)Function available	Functions are less available compare digital multi meter	Functions are more available compare digital multi meter
iii)Power consumption	Power consumption is less	Power consumption is negligible

d) Give method of frequency measurement using Lissagous pattern.

Ans: (Formula 2 M, Explanation 2 M)

Explanation:-

- One of the quickest methods of determining frequency is by using Lissagous patterns produced on the screen .this pattern results when sine waves are applied simultaneously to both pairs of the deflection plates. If one frequency is an integral multiple (harmonic) of the other. The pattern will be stationary and is called a Lissagous figure.
- In this method of measurement a standard frequency is applied to one set of deflection plates of the CRT tube while the unknown frequency is simultaneously applied to the other set of plates. The resulting pattern depend on the integral & phase relationship between two frequencies
- Keep frequency f_h constant and vary frequency f_v ,noting that the pattern . spins in alternate directions and change shape . the pattern will stand still whenever f_v and f_h are in an integral ratio.
- The $f_v = f_h$ pattern stands still and is a single circle or ellipse.(As per fig a)
- When $f_v = 2f_h$ a two loop horizontal pattern is obtained. .(As per fig b)
-



- To determine the frequency from any Lissagous figure, count the number of horizontal loops in the pattern ,divide it by the number of vertical loops and multiply this quantity by f_h (known frequency).

$$f_v = (\text{fraction}) \times f_h$$

Fraction= (No. of loops touches to horizontal tangent) /(no of loops touches to vertical tangent)

e) Draw the schematic diagram of LVDT and describe it's working.

Ans:(Diagram 2 M Working 2M)

Diagram:-

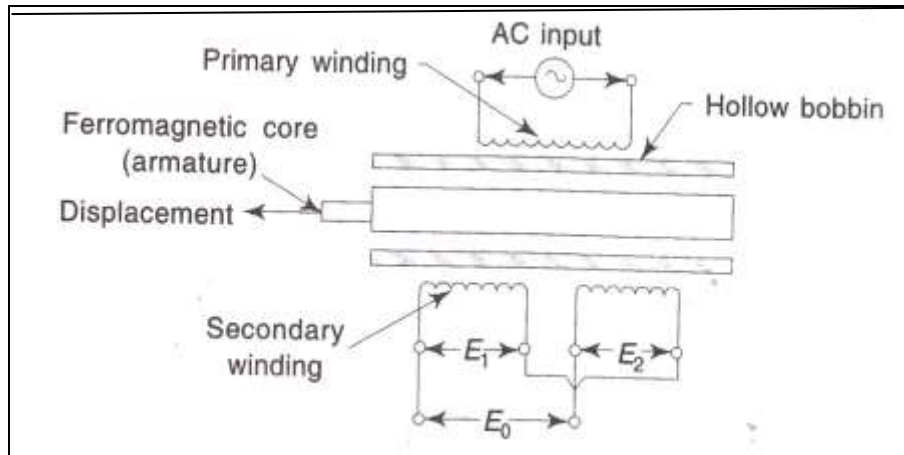


Figure: Schematic diagram of LVDT

Working:

When the core is in the neutral position, voltage induced in the secondary windings are equal and opposite and the net output is negligible.

As the core is moved in one direction from the neutral position the differential voltage, i.e. the difference of the secondary voltage, will increase while maintaining an in phase relationship with the voltage from the source.

Now the core is moved in the other direction from the neutral position. the differential voltage will again increase but will be 180° out of phase with the voltage from the input source.

By comparing the magnitude and phase of the voltage with the input source, the amount and direction movement of the core and hence of displacement may be determined.

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Model Answer

f) Draw block schematic and working of dual trace CRO.

Ans:(Diagram 2 M, Relevant Working 2M)

Diagram:

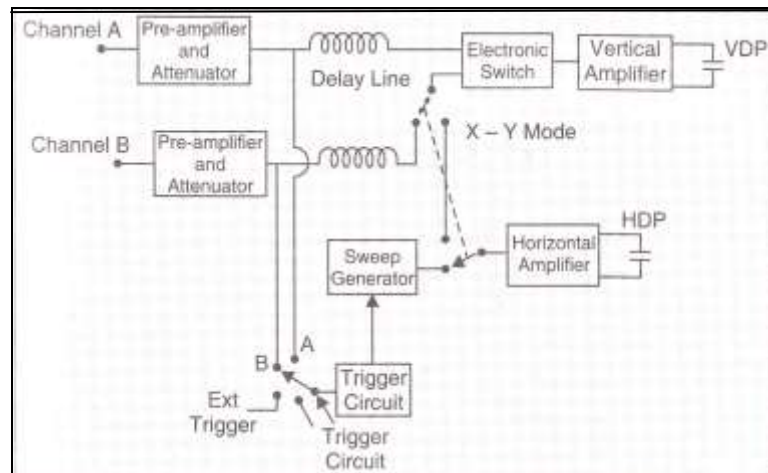


Figure: Block diagram of Dual trace CRO

Working: (consider explanation, alternate mode 1M, and chop mode 1M)

A mode control system (s1) enables the electronic switch to operate in two modes Alternate and chop mode and x-y mode.

Alternate mode:

When the switch (s1) is in alternate position ,the electronic switch feeds each signal alternatively to the vertical amplifier.

The electronic switch alternately connects the main vertical amplifier to channels A and B and adds a different dc component to each signal

This dc component directs the beam alternately to the upper or lower half of the screen.

The switching takes place at the start of each new sweep of the sweep generator.

The switching rate of the electronic switch rate, so that the CRT spot traces the channel A signal on one sweep and the succeeding sweep.

The sweep trigger signal is available from channels A or B and the trigger pick-off takes place before the electronic switch. This arrangement maintains the correct phase relationship between signal A and B.

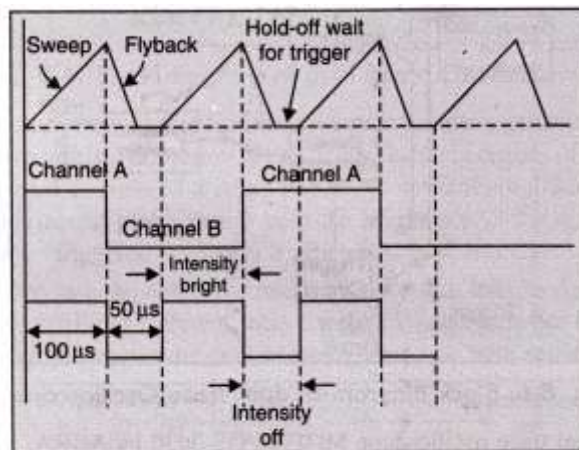


Figure: Time relation of the channel vertical amplifier in alternate mode

Chop mode:

When the switch (s1) is in the chop mode position, the electronic switch is free running at the rate of 100-500 KHz, entirely independent of the frequency of the sweep generator.

The switch successively connects small segments of A and B waveforms to the main vertical amplifier at a relatively fast chopping rate of 500 KHz. e.g. 1 MS segments of each waveform are to the CRT display.

If the chopping rate is slow, the continuity of the display is lost and it is better to use the alternate mode of operation.

Diagram:

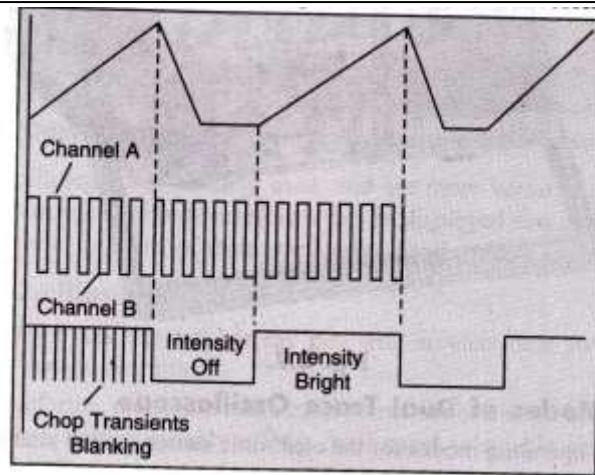


Figure: Time relation of dual channel vertical amplifier in CHOP mode

X-Y mode:

In the x-y mode operation the sweep generator is disconnected and channel B is connected to the horizontal amplifier.

Since both preamplifiers are identical and have the same delay time ,accurate x-y measurements can be made.

Q. 4) Attempt any FOUR of the following:-

16M

a) Define signal generation. Explain the need of generation.

Ans: (Definition 2 M, Need 2 M)

Definition :-

A class of generators that are available as separate instruments to provide signals for general test purpose are usually designated as signal generators.

Need of signal generation:-

These AF & RF generators are designed to provide extensive and continuous coverage over a wide range of frequencies.

AF- 20 Hz to 20 KHz

RF- above 30 KHz

In RF signal generators, additional provision is generally made to modulate the continuous wave signal to provide a modulated RF signal.

b) Write working operation of CRT in a single trace CRO with neat diagram.

Ans: (Diagram 2 ½ , Working 1 ½)

Diagram:

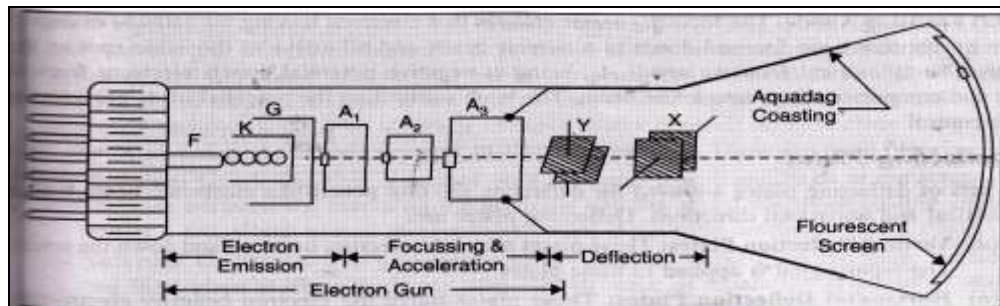


Figure: Operation of CRT in a single trace CRO



Working:

Electrons are emitted from the indirectly heated cathode .typical values of current and voltage required by on indirectly heated cathode are 600 mA at 6.3 v these electrons pass through a small hole in the (control grid).

The intensity of electron beam depends upon the number of electron emitted from the cathode . the grid with its negative bias controls the number of electrons emitted from the cathode and hence the intensity is controlled by the grid.

The electrons are accelerated by high positive potential which is applied to the ‘pre accelerating’ and ‘accelerating anodes’ .the electron beam is focused by the Focusing anode . after leaving focusing anode. The electron beam passes through vertical and horizontal deflection plates and then goes on to the fluorescents screen.

Fluorescent screen of the CRT is coated with a phosphor. at the point where the electron beam strikes the screen phosphor emits a spot of visible light.

If the electron beam is repeatedly moved across the screen the image pointed on scope screen will appear to be a solid line.

c) List four application of video pattern generator.

Ans: (1 M for each)

Application:-

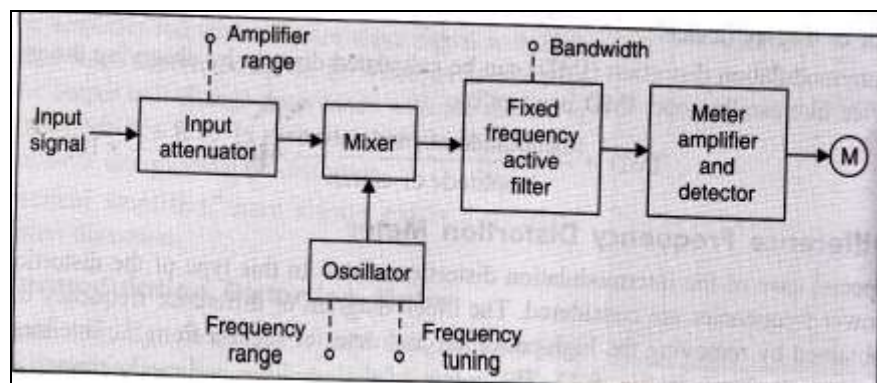
- 1) It is use for test and service the TV monitors.
- 2) It is essential to generate different pattern to differentiate between video and audio signals for alignment, testing, and servicing of television receivers.
- 3) The pattern generators are provided with FM sound signal which can be used for the alignment of the sound card/block of the TV receivers
- 4) The pattern consists of geometrical figure such as circle, ellipses. Horizontal/vertical lines and bans checker board .etc.

NOTE :- (Consider any other relevant application point)

d) Draw the neat labeled block diagram of harmonic distortion analyzer. state its applications.

Ans}(Diagram 2 M, Application 2 M)

Diagram:



OR

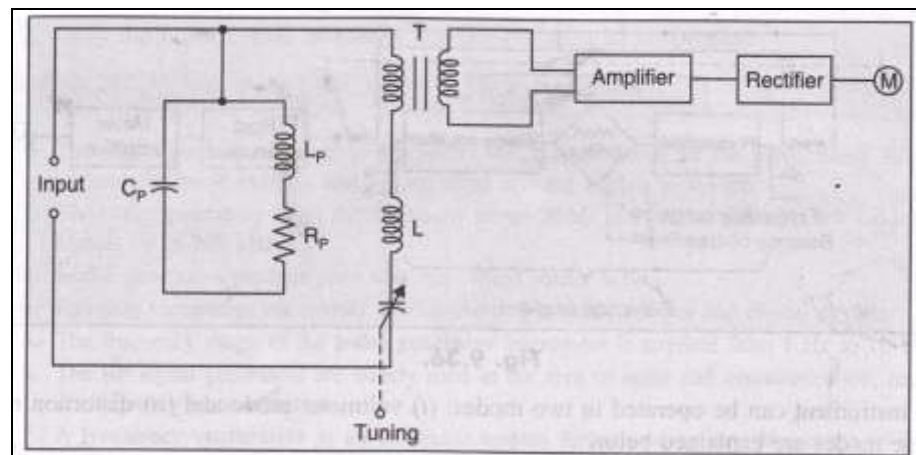


Figure: Harmonic distortion analyzer



Applications of harmonic distortion analyzer :

- The application of a sinusoidal input signal to an electronic device such as an amplifier should result in generation of a sinusoidal output waveform is not an exact replica of input waveform because of various types of distortions .that may occur.
- Distortion may be a result of the inherent nonlinear characteristics of different component used in an electronic CKT.
- Nonlinear behavior of CKT element introduces harmonics in the output waveforms and the resultant distortion is often referred to as harmonic distortion (HD).

NOTE :- (Consider any other relevant point)

e) Differentiate between Active and Passive Transducer.

Ans] Comparison :-

1M each

Sr. No.	Active Transducers	Passive transducers
1.	Do not require external power supply for its operation.	Require external power supply for its operation.
2.	It is also called as ‘Self generating Transducers’.	It is also called as ‘ Externally powered Transducers’.
3.	Operate under energy conversion principle.	Operate under energy controlling principle.
4.	e.g. Thermocouples, Piezoelectric transducer etc.	e.g. Thermistors ,Strain gauges etc.

f) Describe construction of capacitive transducer. Explain its working suitable diagram.

Ans(Diagram 1 M, Construction 1 M, Working 2 M)

Diagram:

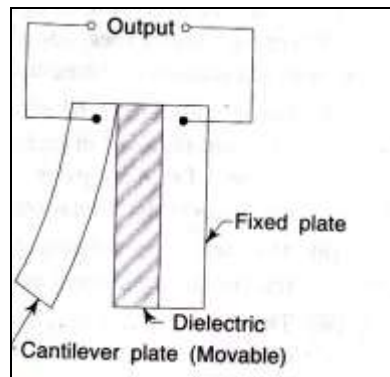


Figure: Construction of capacitive transducer

Construction:

It consists of two plates, one fixed and the other free to move as the displacement is applied on it.

Working:

The movable plate works as a cantilever plate, decreasing the distance between the two plates.

Due to this decrease in distance the capacitance of a capacitor increases.

The air between the two plates works as a dielectric medium.

The capacitance of an air dielectric capacitor does not vary linearly with change in distance between the plates.

For the linearity can be closely approximated by keeping the change in the distance small or by having a medium of high dielectric constant in the space between the two plates.

This type of capacitive transducer may be used to measure displacements.

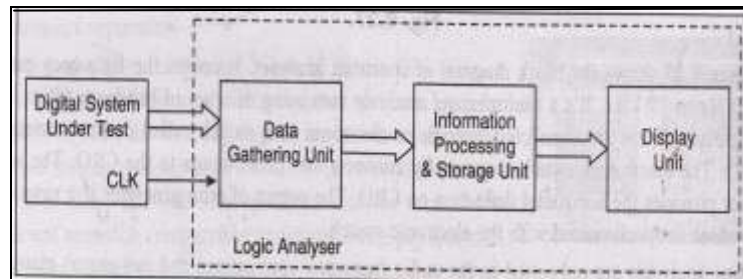
Q5) Attempt any Four of the following:-
16M

a) What are the main function blocks of logic analyzer? Give brief function of each block.

Ans}

02 M each sub questions

Diagram :-



OR

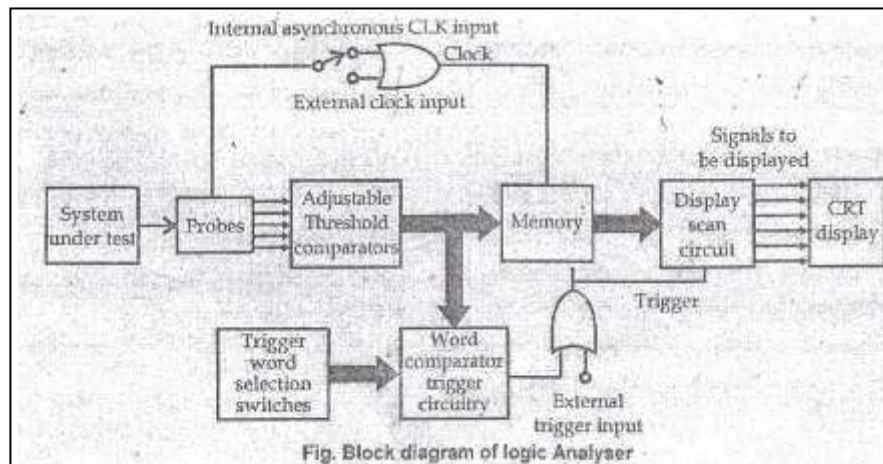


Figure: - Block diagram of logic analyser

Explanation:-

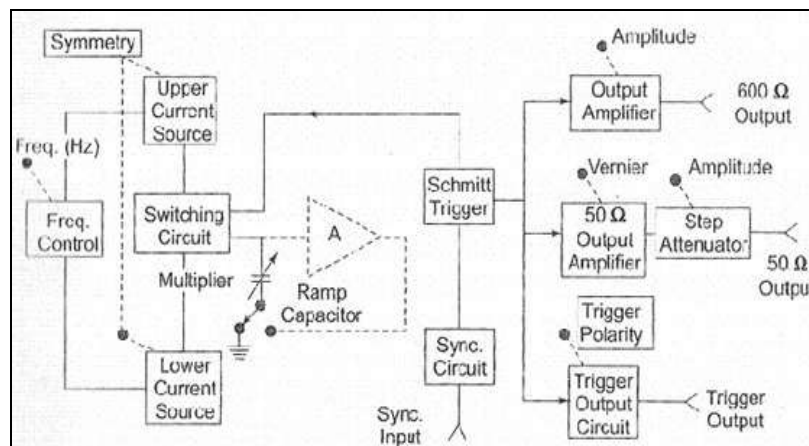
- Data Gathering Unit
 - Information Processing & storage unit
 - Display Unit
- **Data Gathering Unit:-** It has a pad slot for carrying data from digital system under test to the logic analyser. Also a key pad used for entering commands .
- **Information processing storage unit:-** Records all the data from data gathering unit with respect to clock signal. This clock signal determines whether the data is 'high' or 'low' w.r.t defined threshold voltages . This info stored in memory available for detailing to display unit.
- **Display Unit** : It is CRT that displays the command menu for operator and also displays the output data.

(Note: consider Any other relevant diagram as per other ref. books)

b) What is square wave generator ? Sketch the block diagram of square wave generator. State function of each block.

Ans}Block diagram 01 ½ M,

Diagram:-



OR

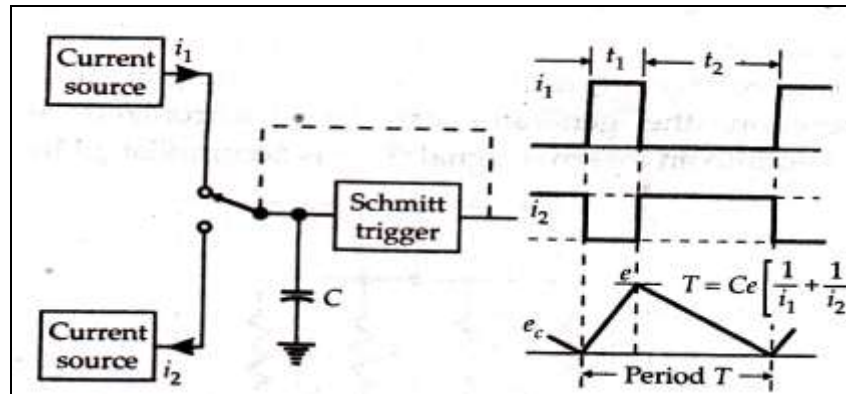


Figure:- Basic block diagram of Square- wave generator

Explanation:-

01M

A signal generator that generates a square-wave output voltage is called Square wave generator. It produces an output voltage with equal on and off times , so that their duty cycle equals 0.5 , or 50 per cent . The duty cyclerequires at 50 per cent as the frequency of oscillation is varied .

Functions of each block:-

01 1/2 M

- Upper current Source and lower current source: these provide constant current for charging and discharging the ramp capacitor. The ratio of these current is set by symmetry control on panel.
- the ramp capacitor: the size of ramp capacitor is decided by the multiplier switch.
- Schmitt trigger circuit : it is bistable multivibrator which changes the state. It provides negative pulses at a continuous rate.



-
- trigger output circuit : It differentiate the square output of Schmitt trigger and invert it and provides positive triggering pulse.

c) Compare time difference and Doppler type ultrasonic flow meter.(Four points).

Ans}

01 M each

Sr.No.	Time Difference	Doppler type
➤	It is transite time method.	It is reflection type method
➤	It is measured from when Transmitter sends the pulse To when the receiver Detects the pulse	It relies on object with varying density in the flow stream to return ultrasonic energy
➤	The velocity of flow is Calculated from time difference between the two stream direction.	The Doppler Effect Ultrasonic Flow meter use reflected ultrasonic sound to measure the fluid velocity. By measuring the frequency shift between the ultrasonic frequency source, the receiver, and the fluid carrier, the relative motion are measured
➤	This method is used for Clean fluids.	This method is used for dirty slurry type Fluids.
➤	Specific dimensions of pipe sizes is required	It can install in any pipe size.

NOTE:- (Consider any relevant valid comparison point)



d) State the advantages of thermistor over RTD.

Ans} Any(two)02M each

- Thermistors are composed of sintered mixture of semiconductor, metal oxides so it is available at lower cost.
- They are available in small sizes and in different shapes, like bead , probe, rod ,discs.
- Give good response at lower ranges of temperature .
- High sensitive at lower temperature range.

e) What is the working principle of thermocouple? Give its classification based on material used and temperature ranges.

Ans}

Working Principle:-

02 M

When two dissimilar metals are join together at their end to form a closed loop. Then it may termed thermocouple. These junctions are exposed to different temperature and then current flows through metal and emf generated. This emf is proportional to the difference in temperature at the junctions.

Classification of Thermocouple:-

02 M

Type	Material	Temperature ranges
J type	Iron-constant	-196 ⁰ c to 760 ⁰ c
K type	Chromel –Alumel	-200 ⁰ c to 1260 ⁰ c
T type	Copper –Constant	-190 ⁰ c to 400 ⁰ c
R type	Pt(87%) Rh(13)- Platinum	-18 ⁰ c to 1400 ⁰ c
S type	Pt (90%) Rh(10%)-Pt	-18 ⁰ c to 1760 ⁰ c
E type	Chromel- constant	-196 ⁰ cto 999 ⁰ c

f) Illustrate the working of RVDT with help of diagram.

Ans} **Diagram:-**

Diagram 02 M , Working 02M

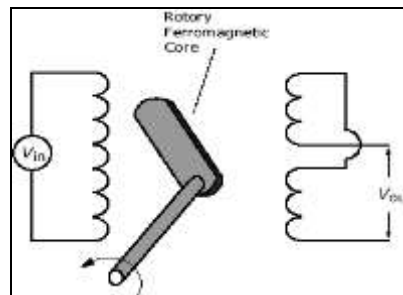


Figure:- Working diagram of RVDT

Working of RVDT :-

It is similar to the LVDT except that its core is cam shaped and may be rotated between the windings by means of a shaft. At primary null position of the core, the output voltage of secondary windings S_1 and S_2 are equal and in opposition. Therefore, the net output is zero. Any angular displacement voltage output. The greater this angular displacement, the greater will be the differential output. Hence the response of the transducer is linear. The amount of angular displacement and its direction is proportional to the magnitude and phase of the output voltage of the transducer.



Q6) Attempt any FOUR:-

16M

a) Write advantage of Digital instrument over analog instrument.

Ans} Advantages of Digital instrument over Analog instrument:-

01 M each

- Digital instruments indicate readings directly in decimal number.
- Its output is in digital form so can be directly feed to memory devices like tape recorder , printer, digital computer etc.
- It has high accuracy as compared to analog instrument.
- Its resolution is more than analog instrument.
- The output of digital instrument is free from observational errors like parallax and approximation of numbers.
- IT require very less power as compared to analog instruments .
- It use is more economical than analog instrument in measurement **system** .

NOTE:- (Consider any other valid points)

b) What is LCR meter? Draw its block diagram.

Ans}

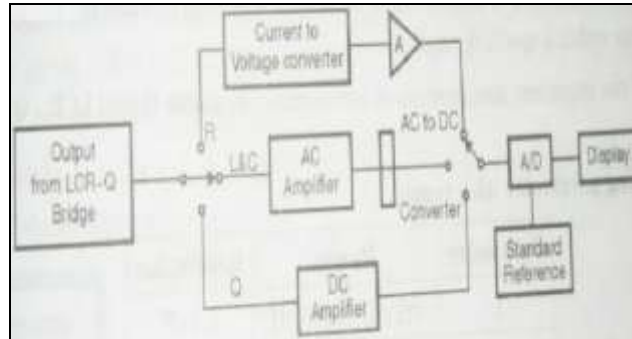
Explanation of LCR meter:-

01 M

LCR meter is an electronic test machine used to measure inductance (L) , Capacitance (C) , & Resistor (R) of a component sensor or other device that's operation depends upon capacitance, inductance , & resistance.

Diagram:-

03 M



OR

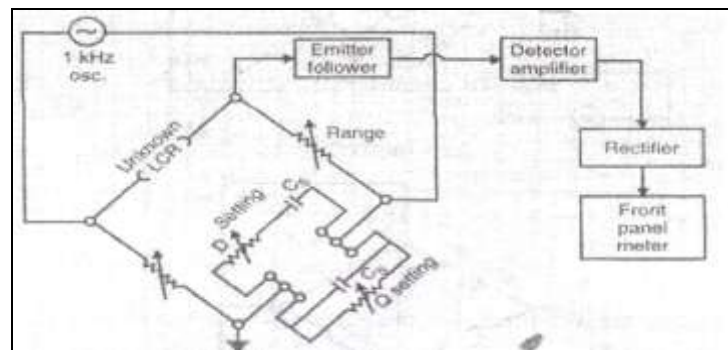


Figure :- Block diagram of LCR meter

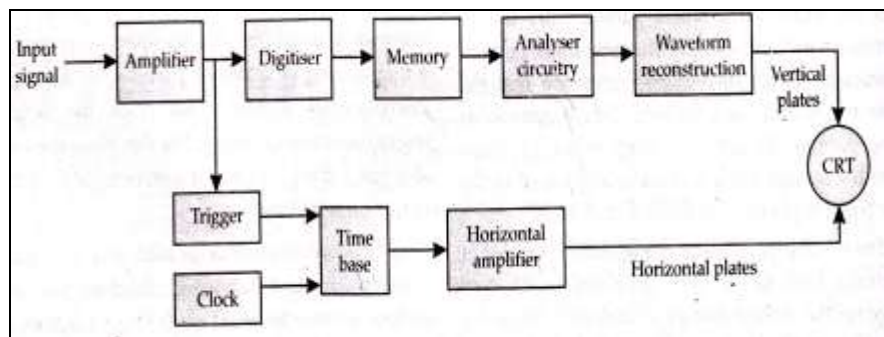
NOTE :- (Consider any one diagram)

c) Draw neat block diagram of DSO. List its applications.

Ans}

Diagram:-

03M



OR

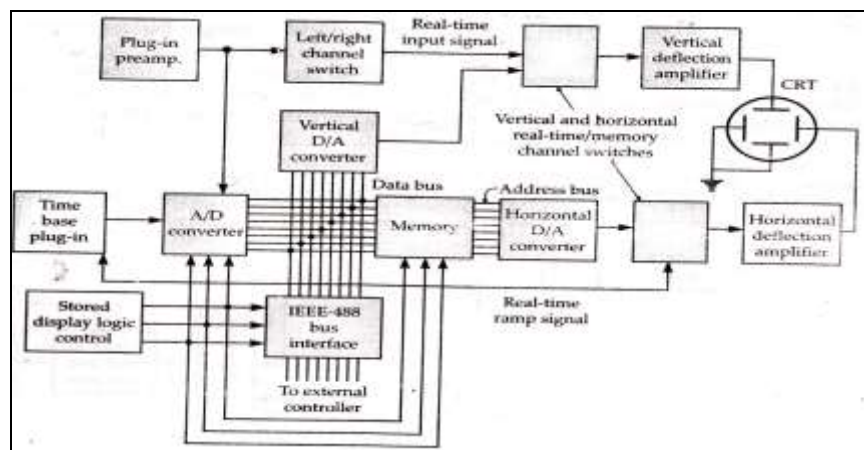


Figure: Basic block diagram of Digital storage oscilloscope



Applications of DSO:-

01M

- **Observation of single –pulse events:** - There are many phenomena which occurs only once. Like occurrence of spike in any signal in a time due to some external effects, is only for the small instant of time. This can be easily recorded by storage oscilloscope and analyzed when it required.
- **Observation of portion of waveform :** -The waveform recorded by storage oscilloscope is analyzed with greater detail.
- **Enlargement of waveform :-** Very small variation in the amplitude and frequency of the waveform is analyzed with this oscilloscope .
- **Mathematical operations:** -Waveform addition , Subtraction , Multiplication, Integration, Differentiation and feature comparison are possible with DSO.
- **As a measuring device :** - It can be used as multimeter , voltmeter , ammeter , ohmmeter, temperature meter etc.

NOTE:- (No need to explain applications)

d) Define Error. List the sources of error in measurement systems.

Ans} Explanation

Definition of Error:-

01M

An error is the deviation of the true value from the desired value.

Sources of error:-

03 M

- **Gross Errors:-** The gross error occurs due to the human mistakes in reading or using the instruments.
- **Systematic errors:-** These are sub divided as :-
 - **Instrumental errors :-** These errors occurs due to inherent shortcomings in the instruments, misuse of instruments and loading effects of the instruments

- **Observational error:-** These are due to carelessness of the operator
- **Environmental error:-** This include condition in the area surrounding the instrument such as the effect of changes in temperature, humidity, barometric pressure or magnetic or electrostatic field .
- **Random error:-** These are due to unknown causes and occur even when all the systematic errors have been accounted for.

Note:- (Considered only the classification of errors not the explanation).

e) With neat diagram explain multi range analog AC voltmeter.

Ans} Diagram:-

02 M

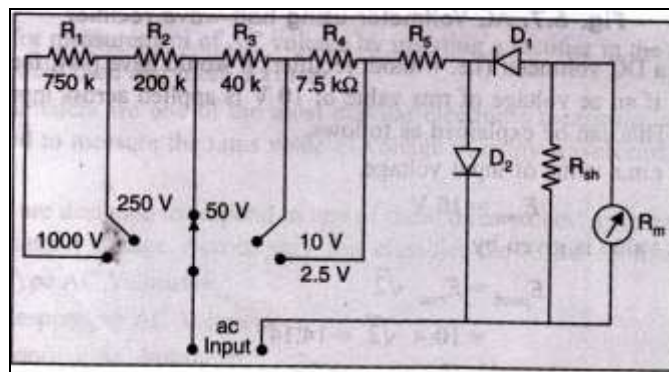


Figure:- Multi range analog AC voltmeter

Explanation:-

02 M

The PMMC meter movement is used for measurement of AC voltage by inserting a rectifier in the measuring circuit. For measuring AC voltage of different ranges multi range Ac voltmeter is designed . A rectifier is used with series of multiplier resistance R_1 , R_2 , R_3 , R_4 , & R_5 . Due different multiplier resistances various voltage ranges is achieved . The resistance R_5 acts as basic multiplier resistance , and Diode D_1 & D_2 is used for full wave rectification.



f) Define (a) Fidelity (b) Lag.

Ans}

02 M each

- **Fidelity:-** The degree to which a measurement system indicated changes in the measured quantity without any dynamic error.

Or

It is the ability of an instrument to produce a wave shape identical to wave shape of input with respect to time.

- **Lag:-** It is the retardation or the delay in the response of the instrument is called lag. There are two types of lag
- Retardation lag &
 - Time delay lag.