WINTER– 16 EXAMINATION (Subject Code: 17435)

Model Answer

Important Instructions to examiners:

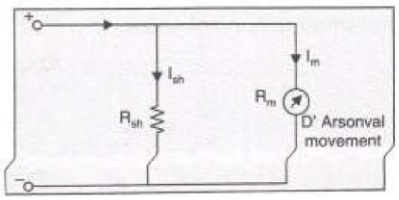
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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. No.	Sub Q.N.	Answer	Marking Scheme
Q.1		**Attempt any SIX of following**	**12 Marks**
1	**a)i)**	**Define active transducer. Give two examples.**	**2 M**
	Ans:	Active transducer is transducers which do not required power supply for converting one form of energy to another. **OR** Active transducer is transducer which do not required power supply for converting non-electrical quantity (like temperature, pressure, humidity etc.) into electrical quantity.e. g. Thermocouples, Piezoelectric transducer etc.	**1 M** **1 M**
	ii)	**State the difference between absolute and secondary instruments.**	**2 M**
	Ans:	Absolute instrument:- The absolute instrument measures the 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.	**1 M** **1 M**
	iii)	**State the role of delay line in CRO.**	**2 M**
	Ans:	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.	**2 M**

iv)	**Write the units of temperature.**	**2 M**
Ans:	Several scales and units exist for measuring temperature, the most common being Celsius (denoted °C; formerly called centigrade), Fahrenheit (denoted °F), and, especially in science, Kelvin (denoted K).	**2 M**
v)	**State any four applications of DSO.**	**2 M**
Ans:	**Any four application of DSO:** • It can be used to measure ac as well as dc voltages and currents. It can calculate the mean value, peak value, peak to peak value, duty cycle, etc. • It can be used to measure frequency, time period, time interval between two signals, and phase for periodic as well as non-periodic signals. • It is used to give the visual representation for a target of radar such as aero plane, ship etc. • In medical fields, it is used to display cardiograms that are useful for diagnosis of heart of the patient. • It can be used to determine the modulation characteristic and detect the standing waves in transmission lines. • It can be used to observe the V- I Characteristics of diodes, transistors. • It can be used to observe the B-H curves, P-V diagrams. • It can be used to observe the radiation pattern generated by the transmitting antenna. • In modern DSO it is possible to add, subtract the waveforms.	**½ M each**
vi)	**Compare RF and AF type signal generator(Any two)**	**2 M**
Ans:		**1M for each point**

RF signal generator	AF signal generator
This type of signal generator is used to generate RF or radio frequency signals.	This type of signal generator is used for audio applications. Signal generators such as these run over the audio range, typically from about 20 Hz to 20 kHz and more.
RF signal generators use frequency synthesizers to provide the stability and accuracy needed	AF signal generator uses free running oscillators, although some used frequency locked loop techniques to improve stability.

vii)	**State the need of transducer.**	**2 M**
Ans:	A transducer is required to converts a signal in one form of energy to a signal in another.. Where electrical signals are converted to and from other physical quantities (energy, force, torque, light, motion, position, etc.). The process of converting one form of energy to another is known as transduction.	**Need-2M**
viii)	**State the principle of piezoelectric transducer. State its any one application.**	**2 M**
Ans:	**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. **OR** The transducers that work on the principle of piezoelectric effect to measure changes in	**Principal-1M & Applicatio n-1M**

	displacement, force, pressure, strain and acceleration converting them to Electric charge are termed as Piezoelectric Transducers. This transducer produces electric voltage When there is application of mechanical stress or forces along certain planes. **Applications:** • These are used for the measurement of Displacement. • Piezoelectric crystal is also used for measurement of force, pressure or acceleration.	
b)	**Attempt any TWO of following:**	**8 Marks**
i)	**Write the classification of transducers. Classify the following transducers** **1)Thermistor** **2)LVDT ?**	**4 M**
Ans:	**Transducer classification (any four criteria)** Primary & secondary transducer. · Active & passive transducer. · Analog & Digital transducer. · Transducer & inverse transducer. · Electrical &mechanical transducer Thermistor :- Passive Transducer LVDT :- Secondary transducer.	**Classification-2M** **1M** **1M**
ii)	**Define following:** **1)Sensitivity** **2)Accuracy**	**4 M**
Ans:	**Sensitivity:** The ratio of change in the output of an instrument to the change in input. It is expressed in terms of milivolt, microvolt or tenth of a degree. **Accuracy:** Accuracy refers to the closeness of a measured value to a standard or known value.	2M for each define
iii)	**Draw and explain shunt resistor type DC ammeter.**	**4 M**
Ans:	 **Explanation:-** Where ,Rm=Internal resistance Rsh= Resistance of the shunt Im= Full scale deflection current Ish= Shunt current I=current to be measured Vshunt= Vmovement	**2M-Diagram & 2M-Explanation**

IshRsh=ImRm
and
Rsh=ImRm/Ish
Ish=I-Im

The coil winding of basic movement is small & it is light in weight. So this coil enables small currents to pass through it. It is required to pass current range through coil then the construction become bulky. In order to avoid this resistor is connected in parallel with the basic movement. This resistor is called is shunt resistor. So major amount of current passes through it & a small current passes through the coil.

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

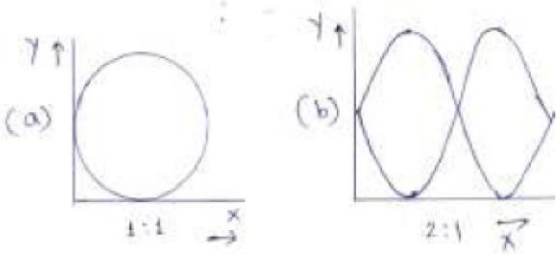
Rearranging the above equation we get,

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

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

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

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

Q 2		**Attempt any FOUR of the following.**	**16 Marks**
	a)	**Describe lissagous figure.How are used to determine phase and frequency.**	**4 M**
	Ans:	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. **Frequency measurement using Lissagous pattern:** 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 depends on the integral & phase relationship between two frequencies. Keep frequency fh constant and vary frequency fv , noting that the pattern. Spins in alternate directions and change shape. The pattern will stand still whenever fv and fh are in  Fig.a Fig.b an integral ratio. The fv = fh pattern stands still and is a single circle or ellipse. (As per fig a)	**Describe-2M & phase-1M & Frequency -1M**

When fv=2fh 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 fh (known frequency).
Fv = (fraction)× fh
Fraction= (No. Of loops touches to horizontal tangent) /(no of loops touches to vertical tangent)

Phase measurement using Lissagous pattern:

Explanation:-
1. The Phase measurement can be done by using Lissagous Figures.
2. The CRO is set to operate in X-Y mode, then the display obtained on the screen of a CRO is called as Lissagous
pattern (Figure), when two sine waves of the same frequency are applied to the CRO.(one vertical and one horizontal
Deflection plates).
3. Depending upon the phase shift between the two signals, the shape of the Lissagous

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

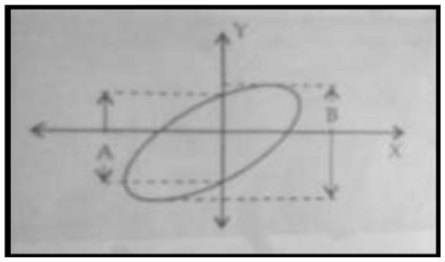
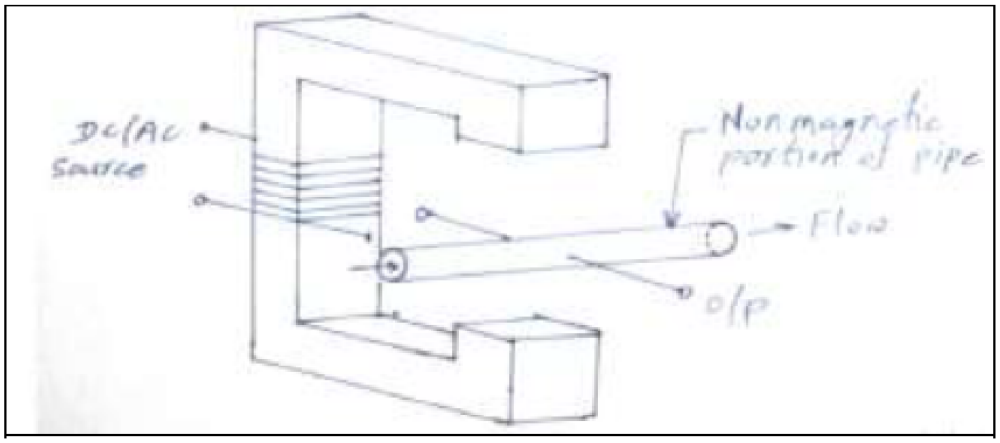


figure will go on changing.
4. The Phase shift is given by $\Theta = \sin^{-1}(A/B)$

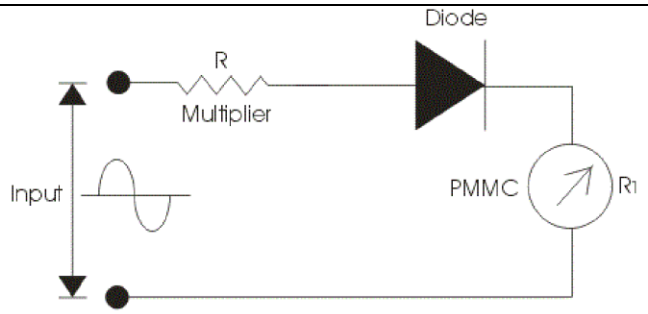
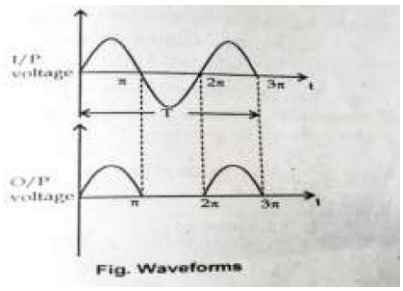
b)	**Draw and explain the working of electromagnetic flowmeter.**	**4 M**
Ans:	 **Figure:- Electromagnetic flow meter**	**Diagram- 2M & Working- 2M**

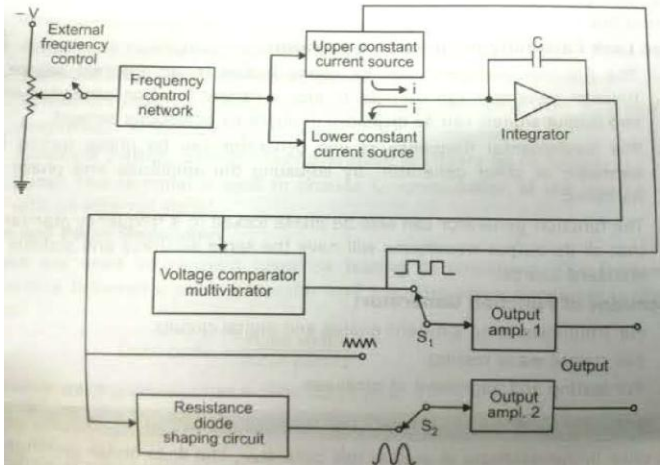
Working :-

The operation of this type of flow meter is based on Faraday's law of electromagnetic Induction. The law state that whenever the conductor moves through a magnetic field, an e.m.f is induced in the conductor proportional to the relative velocity between the conductor & the magnetic field.

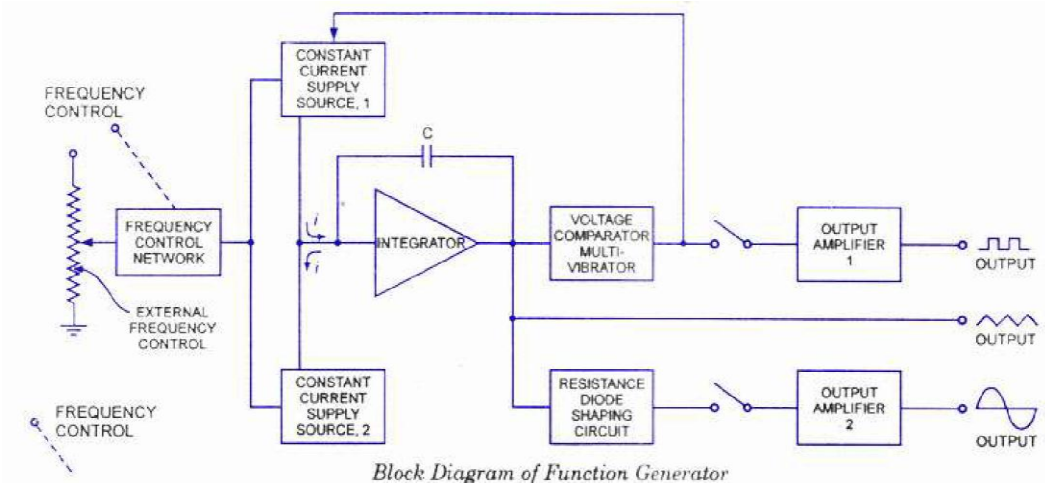
It consists of a pipe, short section of which is subjected to a transverse magnetic field. The Conductive fluid is passed through this pipe. As fluid passes, its motion relative to field produces an e.m.f proportional to velocity according to Faraday's law.

This output e.m.f is collected by the electrodes (kept at points of maximum potential Difference) and is given to external circuitry.

c)	**Explain the seebeck and peltier effect.State its application.**	**4 M**
Ans:	**Seeback effect** : Seeback effect states that whenever two dissimilar metals are connected together to form two junctions, out of which, one junction is subjected to high temperature and another junction is subjected to low temperature then e.m.f is induced proportional to the temperature difference between two junctions. **Application:** Seeback effect is used to measure the temperature difference between two objects. **Peltier effect :** Peltier effect state that two dissimilar metals closed loop, Id current forced to flow through the closed loop then one junction will be heated and other will become cool. **Application:** It can be used either for heating or for cooling, in practice the main application is cooling. It can also be used as a temperature controller that either heats or cools.	**Seebeck and peltier effect & applicatio n-1M for Each**
d)	**Draw and explain half wave rectifier type AC voltmeter.**	**4 M**
Ans:	  Fig. Waveforms **Explanation**: • The circuit given in which the rectifying element (diode) is connected in series with Sinusoidal voltage source, PMMC, and multiplier resistor. • The Function of Multiplier is to limit the current drawn by the PMMC to ovoid it from damage. • The diode conducts during positive half cycle and does not conduct during negative half cycle. • The average current through the meter will be given by the expression. **Iav = Vav / 2R = 0.45 * [Vrms/R]**	**Diagram-2M & Explanatio n-2M**

e)	**Describe the working of function generator wih suitable diagram.**	**4 M**
Ans:		**Diagram- 2M & Working- 2M**

OR



Block Diagram of Function Generator

Working:

- The frequency is controlled by varying the capacitor in LC or RC circuit. In this instrument the frequency is controlled by varying the magnitude of current which drives the integrator. The instrument produces sine, triangular and square waves with a frequency range of 0.01 Hz to 100 kHz.
- The frequency controlled voltage regulates two current sources. The upper current source supplies constant current to the integrator whose output voltage increases linearly with time, according to the equation of the output signal voltage.

$$V_o = -\frac{1}{C}\int i.dt$$

- An increase or decrease in the current increases or decreases the slope of the output voltage and hence controls the frequency.
- The voltage comparator multivibrator changes states at a pre- determined maximum level of the integrator output voltage. This change cuts off the upper current supply and switches on the lower current supply.

- The lower current source supplies a reverse current to the integrator, so that its output decreases linearly with time. When the output reaches a pre-determined minimum level, the voltage comparator again changes state and switches on the upper current source.
- The output of the integrator is a triangular waveform whose frequency is determined by the magnitude of the current supplied by the constant current sources.
- The comparator output delivers a square wave voltage of the same frequency. The resistance diode network alters the slope of the triangular wave as its amplitude changes and produces a sine wave with less than 1% distortion.

f) Compare digital and analog instruments.(Any four) — **4 M**

Ans: — **1M for Each point**

Analog instrument	Digital instruments
The instrument that displays analog signals is called as an analog instrument.	The instrument that displays digital signals is called as an digital instrument
The accuracy of analog instrument is less	The accuracy of digital instruments is more
The resolution of analog of analog instrument is less	The resolution of digital instruments is more.
The analog instrument require more power	The digital instrument requires less power.
Examples PMMC instrument DC voltmeter ,DC ammeter	Examples Logical analyzer, Digital analyzer, computer base instruments.

Q. 3 — **Attempt any FOUR of the following.** — **16 Marks**

a) Describe the working of analog AC ammeter. — **4 M**

Ans: — **Explanation-4M**

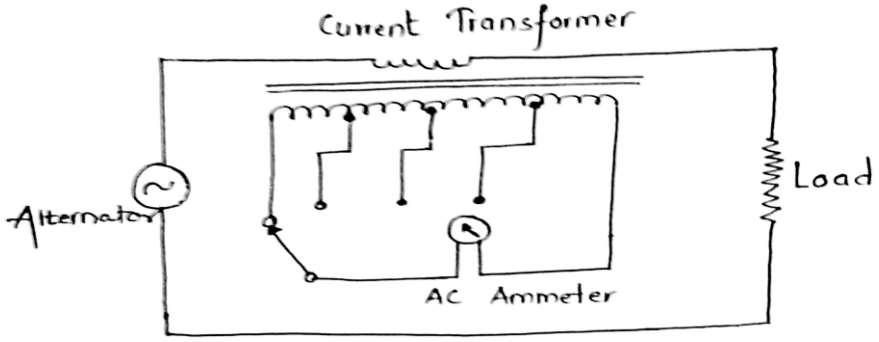


fig : Analog AC Ammeter

Explanation:

1. Shunt can be used with A.C ammeter to increase their range but cannot be used to decrease their range.
2. Most AC ammeter use a current transformer instead of shunts to change the scale values. This type of Ammeter is shown in the diagram.

3. The primary of the transformer is connected in series with the load, and ammeter is connected to the secondary of the transformer.

4. The range of meter is changed by selecting different taps on secondary of transformer. The different taps on the transformer provides different turn's ratio between primary and secondary of the transformer.

5. The turn's ratio is the ratio of number of turns of wire on the primary as compared to the number of turns of wires in the secondary.

b)	**Draw the block diagram of logic analyzer and explain its working.**	**4 M**
Ans:		**Digram- 2M & Working- 2M**

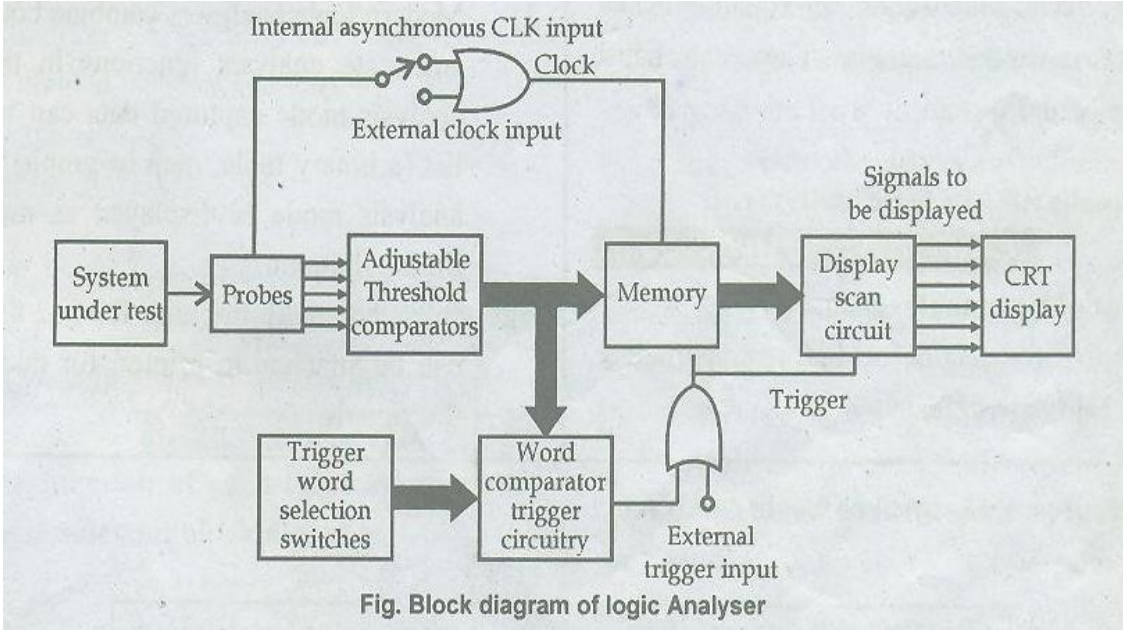


Fig. Block diagram of logic Analyser

Explanation:

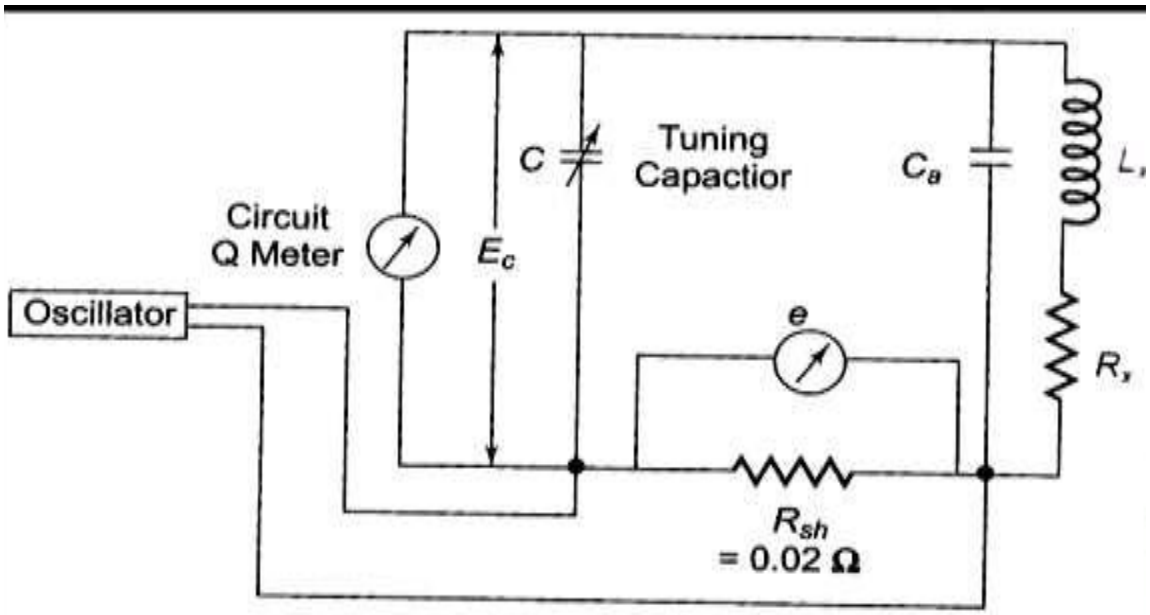
1. Logic analyzer used to analyze digital signals. Logic analyzer deals with digital domain.

2. This is basically multichannel oscilloscope. The probes connect the logical analyzer to system which is under test. The probes operates as voltage divides, the lowest possible s/w rate can be selected by dividing the i/p signal.

3. The different logic families i.e. TTL, CMOS, NMOS…etc. have different threshold voltage. Hence adjustable threshold comparators are used. Each signal is connected to each line of logic analyzer.

4. The reference signal of each comparator is set to a voltage. The logic analyzer memory consists of a RAM.

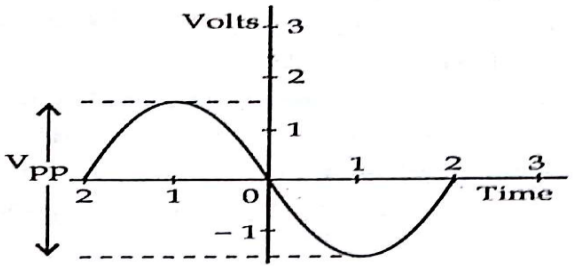
5. The clock signals I.e, internal or external clock i/p is connected to memory on receiving

	c)	**Draw LCR-Q meter.State its application.**	**4 M**
	Ans:	 Applications: (2Marks-consider Any 2 points) 1. In the Measurement of different parameters like inductance, capacitance, resistance, dissipation factor, quality factor, current, voltage, phase angle between the current and voltage, conductance, susceptance etc. quickly with very high precision. 2. Data collection and Automation is made easy with a wide variety of interfaces such as; USB, USB Host Port, RS-232 and GPIB interfaces, which are available on all of IET's LCR-Q meters. **3.** They are highly used in industry.	**Diagram-2M & Applicatio n- 1M each**
	d)	**Explain how frequency and voltage measurement is done in CRO with suitable example.**	**4 M**

Ans:

a) Measurement of A.C. voltage :

- Apply the unknown a.c. voltage signal to vertical input.
- In order to measure the voltage from CRT display, one must observe the vertical attenuator expressed in volts/div and the number of divisions of the beam.
- The peak to peak value is then computed as,



$$V_{PP} = \left(\frac{\text{Volts}}{\text{div}}\right) \times \left(\frac{\text{no. of divisions}}{1}\right)$$

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

$$V_{rms} = 0.707 \times V_m = \frac{1}{2\sqrt{2}} V_{PP}$$

where, V_m : peak voltage

V_{p-p} : peak to peak voltage

b) Measurement of d.c. voltage :

- While measuring d.c. voltage shift a coupling switch is applied to dc level.
- Then apply dc voltage to vertical input, a deflection (shifting) of line occurs from its initial position which is a measure of dc voltage.

Example:

EXAMPLE ON VOLTAGE MEASUREMENT

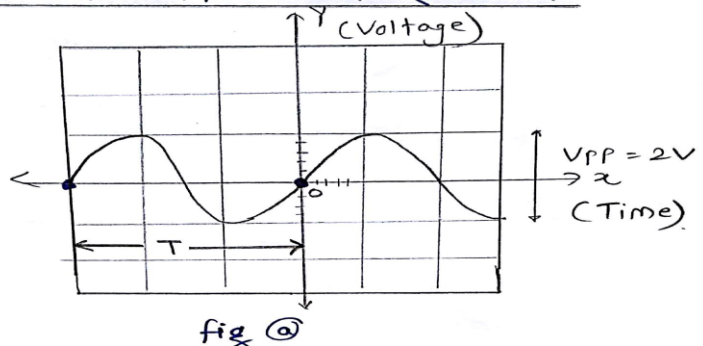


fig @

from above figure we can write

V_{PP} = 2V, & if Volts/div knob on CRO is at 1 V/div then,

$$V_{PP} = [1] \times [2]$$

$$\boxed{V_{PP} = 2V}$$

Frequency and voltage measurement-2M for Each

(OR)

Can consider same type of example for DC Measurement.

Frequency Measurement : The frequency can be measured accurately on CRO by two ways On calibrated ciao : In this method, the frequency can be found out indirectly. The signal whose frequency is to be measured is applied to the vertical input terminal and switch ON the sweep generator then count the number of division covered by one cycle of the signal on the screen.

$$T = \left(\frac{\text{time}}{\text{division}}\right) \times \left(\frac{\text{No. of division}}{\text{cycle}}\right)$$

The frequency can be calculated by :

$f = 1/T$ cycles /sec

EXAMPLE ON FREQUENCY MEASUREMENT –

from fig @

No. of divisions completed by 1 cycle of waveform is 3 & if Time/div knob on CRO is at 1ms/div. then,

$T = [1 \times 10^{-3}] \times [3]$

$T = 3 \times 10^{-3}\ s$

The frequency is calculated as,

$f = \frac{1}{T}$

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

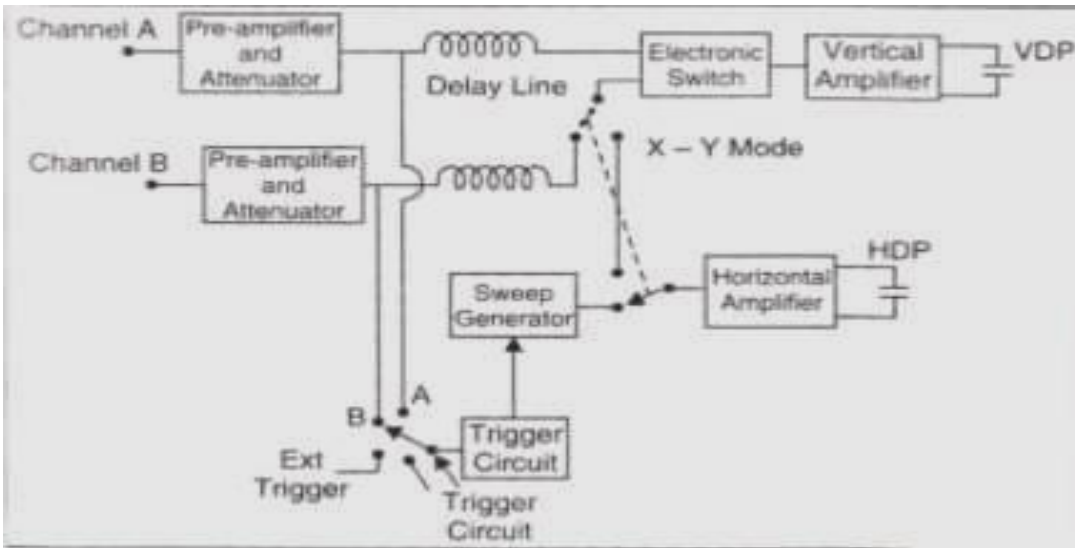
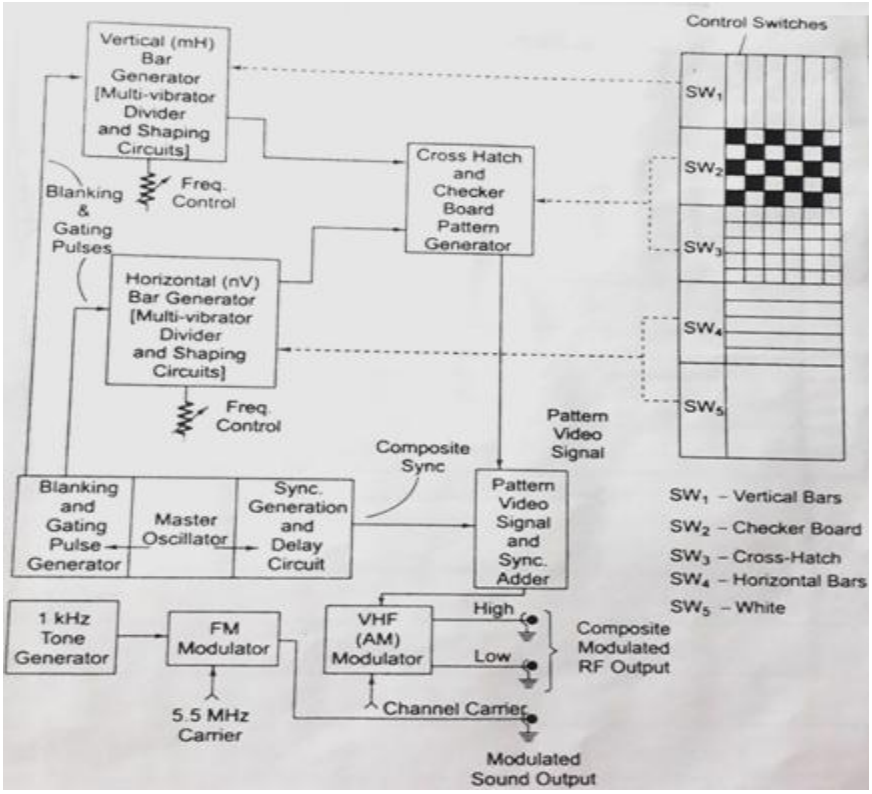
$= 0.333 \times 10^{3}$

$f = 0.33\ KHz$

e) List the temperature range and material used for J,K,S,R thermocouple. **4 M**

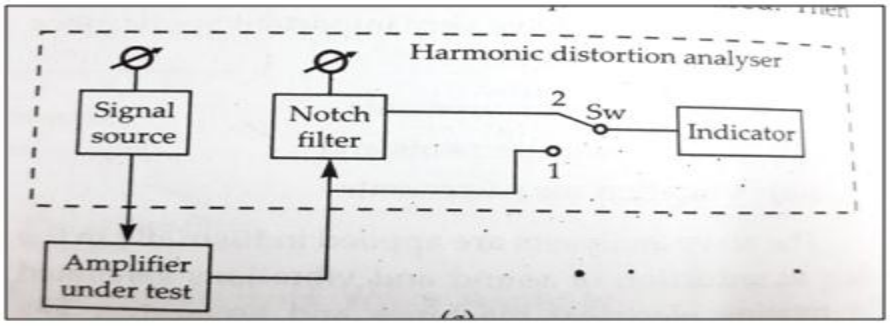
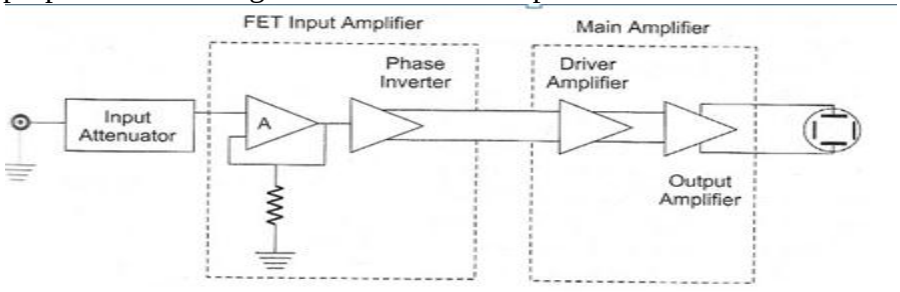
Ans: **1M for Each Point**

Sr. No.	Type of transducer	Material used	Temperature range in (degree. Celsius)
1	J	Iron-Constantan	-180 to +850
2	K	Chromel-Alumel	-200 to +1300
3	S	Platinum-Platinum/ 10% Rhodium	-0 to +1400
4	R	Platinum-Platinum/ 13% Rhodium	-0 to +1600

	f)	**Draw a neat labelled block diagram of dual trace CRO.**	**4 M**
	Ans:		**2M- Diagram & 2M- Lebelled**
Q. 4		**Attempt any FOUR of following:**	**16 Marks**
	a)	**Describe the working of video pattern generator.**	**4 M**
	Ans:	***block diagram:*** 	**Explanation-4M**

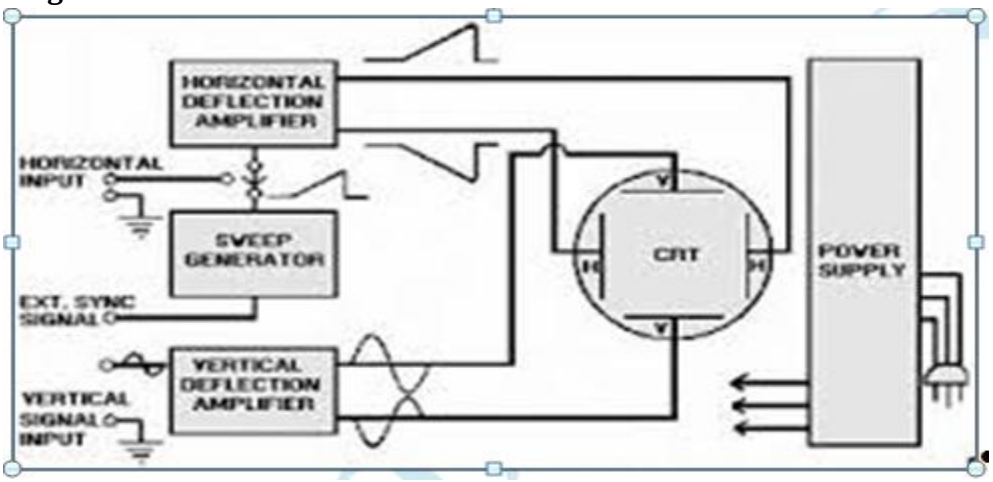
Explanation:

A pattern generator provides video signals directly with RF modulation on standard TV channels for alignment, testing and servicing of TV receivers. The output signal is designed to produce simple geometric patterns like vertical and horizontal bars , checker board, cross hatch dots etc. an FM sound is also provided in pattern generators for aligning sound sections of the receiver. The generator employs two stable chains of multivibrator,

		divider and pulse shaping circuits to produce a series of horizontal bars below the line frequency and vertical bars above the 15.6KHz. Vertical bars are used to check and set horizontal linearity. Similarly Horizontal bars are used to check and set vertical linearity Picture centering and aspect ratio is checked and set with cross hatched pattern by counting the number of squares on the vertical and horizontal sides of the screen.	
	b)	**Draw block diagram of harmonic distortion analyzer. Explain its working.**	**4 M**
	Ans:	***Block Diagram :***  ***Explanation:*** The signal has very low distortion and this can be checked by reading its o/p distortion by connecting directly into analyser The signal from source is fed to the amplifier under test. This generates harmonics and original fundamental frequency. The original fundamental frequency is removed by notch filter. The switch is first placed in position 1 and total content of fundamental & harmonics (E_T) is measured. Then the switch is moved to position 2 to measure just the harmonics (E_H). The value of THD total harmonic distortion is then found $$THD = \frac{E_H E_H}{E_T E_T} \times 100$$ Explain the role of vertical deflection and horizontal system in CRO.	**Diagram-2M & Working-2M**
	c)	**Explain the role of vertical deflection and horizontal deflection between in CRO**	**4 M**
	Ans:	***Explanation:*** **Vertical Deflection System** consists of Attenuator Network, Vertical amplifier. Attenuator reduces the amplitude of the signal before applying to the vertical amplifier. The main function of vertical amplifier is to determine the sensitivity and bandwidth (range of frequencies which can be produced accurately on CRT screen) of an oscilloscope (in terms of V/cm.) The gain of vertical amplifier determines the smallest signal that the oscilloscope can satisfactorily produce on CRT screen. The sensitivity of an oscilloscope is directly proportional to the gain of the vertical amplifier.  	**Explanation-2M for horizontal deflection and 2M for vertical deflection**

Horizontal Deflection System consists of trigger circuit ,sweep generator and horizontal amplifier. The horizontal (x) deflection plates are fed by a sweep voltage that provides a time base. The horizontal plates are supplied through an amplifier, but they can be fed directly when voltages are of sufficient magnitude.

Block Diagram



d) Draw the block diagram of pulse generator. State the difference between square wave generator and pulse generator. **4 M**

Block Diagram:

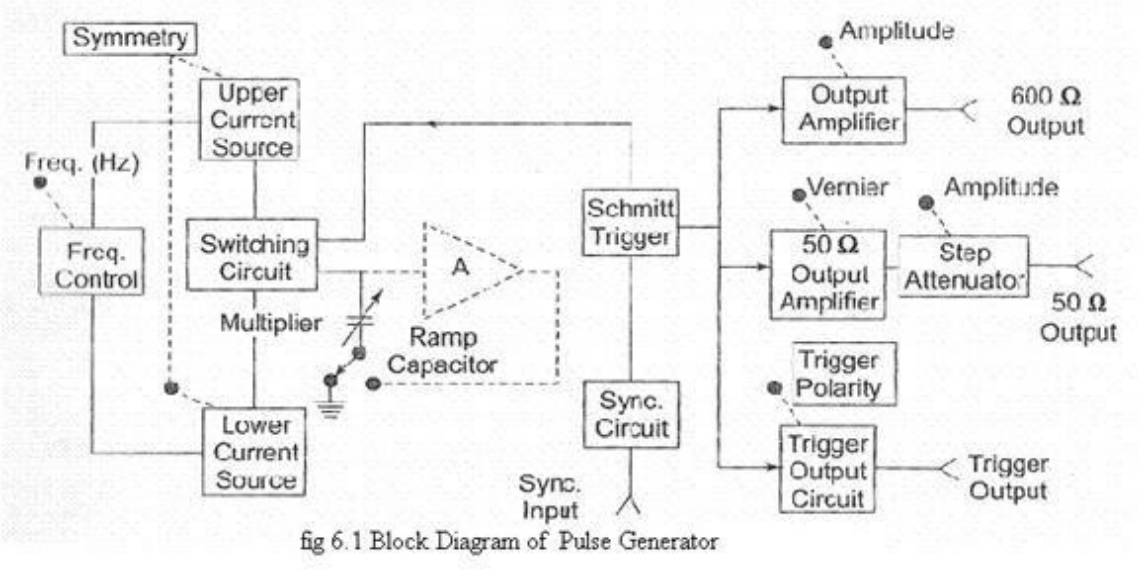
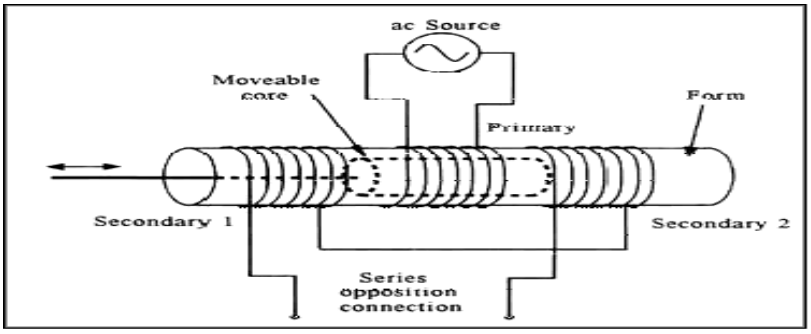
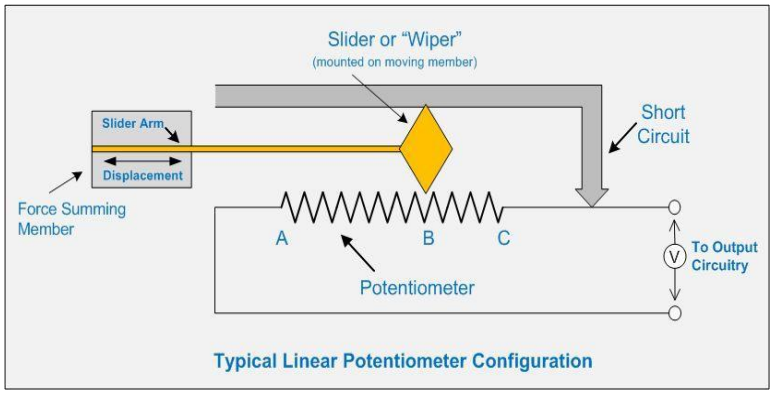


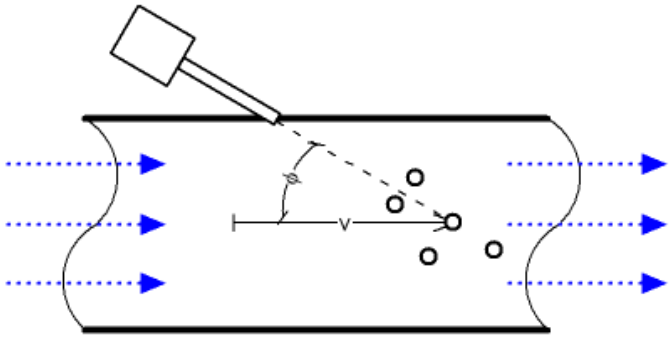
fig 6.1 Block Diagram of Pulse Generator

Diagram:2 M & 1 mark each point(max. 2 point).

The difference between square wave and pulse generator.

Square Wave generator	Pulse Wave generator
1. Square wave generator produce square waveform.	1. Pulse wave generator produce Pulse of different width.
2. Duty cycle is exactly equal to 50%.	2. Duty cycle is varied between 50-70%.
3. Square wave generators are used where low, power, low frequency characteristics is to be investigated. For example Audio system.	3.Pulse generator is used in comparatively higher power application

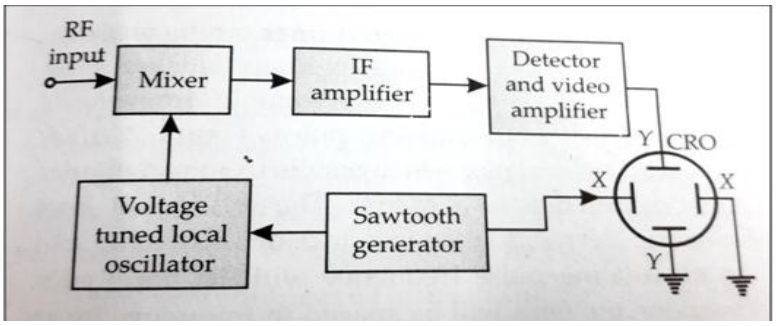
	e)	**Draw neat circuit diagram of LVDT. State it's any four applications.**	**4 M**
	Ans:	**Diagram:**  **Application of LVDT:** 1. It is used for small displacement measurement i.e from fraction of mm to few cm. 2. It is used as secondary transducer to measure force, pressure, weight in electrical quantity. 3. It is used to measure the thickness of metal sheet roll. 4. It is used to measure tension in a cord. **5.** LVDTs are commonly used for position feedback in servomechanisms, and for automated measurement in machine tools and many other industrial and scientific applications.	**2M – Diagram & ½ M for each Application**
	f)	**Draw and explain the working of linear potentiometer.**	**4 M**
	Ans:	Diagram  Working: The potentiometer is also called as pots and it one of the most commonly used devices for measuring the displacement of the body. The potentiometer is the electrical type of transducer or sensor and it is of resistive type because it works on the principle of change of resistance of the wire with its length. The resistance of the wire is directly proportional to the length of the wire, thus as the length of the wire changes the resistance of the wire also changes to change the resistance one sliding contact is provided is called as wiper. The movement of this wiper is translator so called as linear potentiometer.	**Diagram:2 M & Working:2 M**

Q.5		Attempt any FOUR of following:	16 Marks
	a)	**Describe how flow is measured using Doppler type ultrasonic flow meter.**	**4 M**
	Ans:	 ***Note: Explanation: 4marks only describe is ask in question*** Doppler flow meters use a single-head sensor design allowing fast, simple mounting on the outside of pipes. The single-head transducer includes both transmit and receive piezo-electric crystals in the same housing. Doppler flow meters use the principal that sound waves will be returned to a transmitter at an altered frequency if reflectors in the liquid are in motion. This frequency shift is in direct proportion to the velocity of the liquid. It is precisely measured by the instrument to calculate the flow rate. So the liquid must contain gas bubbles or solids for the Doppler measurement to work. The fluid velocity can be expressed as $v = c\,(f_r - f_t) / 2\, f_t \cos\Phi$ *(1)* *where* f_r = *received frequency* f_t = *transmission frequency* v = *fluid flow velocity* Φ = *the relative angle between the transmitted ultrasonic beam and the fluid flow* c = *the velocity of sound in the fluid*	**Explanation : 4M**
	b)	**Draw the block diagram of spectrum analyzer. Explain its working.**	**4 M**
	Ans:	**Working:** • A spectrum analyser provides a calibrated graphical display on its CRT, with frequency on the horizontal axis and amplitude (voltage) on the vertical axis. • Displayed as vertical lines against these co-ordinates are sinusoidal components of which the i/p signal is composed. The height represents the absolute magnitude and the horizontal location represents the frequency. • Referring to the block diagram of the basic spectrum analyser, the saw tooth generator provides the saw tooth voltage which drives the horizontal axis element of the scope and this saw tooth voltage is the frequency controlled element of the voltage tuned oscillator. • As the oscillator sweeps from f min to f max of its frequency band at a linear recurring rate, it beats with the frequency component of the input signal and	**Working:2 M & Block Diagram 2M**

produce an IF, whenever a frequency component is met during its sweep.

- The frequency component and voltage tuned oscillator frequency beats together to produce a difference frequency, i.e. IF. The IF corresponding to the component is amplified and detected if necessary and then applied to the vertical plates of the CRO producing a display of amplitude versus frequency. Spectrum analyzers are widely used in radar, oceanography and biomedical fields.

Diagram:



c) Define signal generator. State the need of signal generator. — **4 M**

Ans: 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 Generators: Signal Generators provide various signal which are required for testing the electronic circuits, frequency response at transmitting and receiving stage. So the need is

1. The frequency of the signal should be known and stable.
2. The amplitude should be controllable from very small to relatively large values.
3. Finally, the signal should be distortion free.

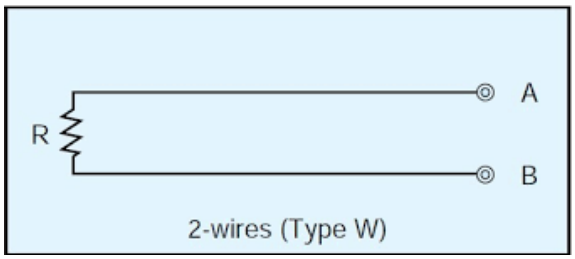
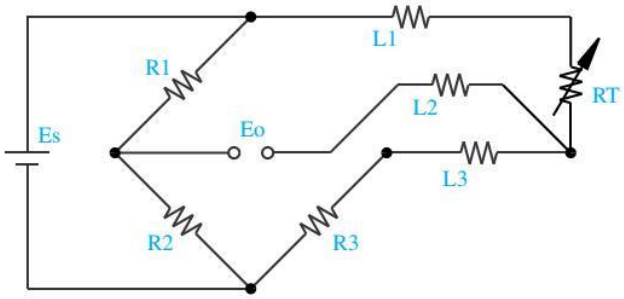
Define:1M & Need:3M

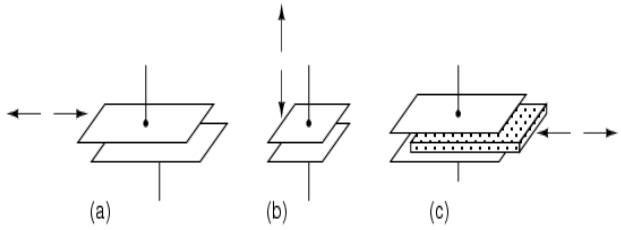
d) Compare thermistor and RTD(Any four) — **4 M**

Ans:

Thermister	RTD
1.Thermistor is made up of semiconductor Materials.	1. RTD is made up of metals.
2.Semiconductor materials have Negative Temperature Coefficient (NTC) of resistance.Hence, the resistance of a thermistor decreases with an increase in temperature and increases with a decrease in temperature.	2. Metals have Positive Temperature Coefficient (PTC) of resistance. Hence,the resistance of RTD increases with an increase in temperature and decreases with a decrease in temperature.
3.The resistance temperature characteristics of thermistor are highly nonlinear.	3. The resistance temperature characteristics of RTD's are linear.
4.It has large temperature coefficient of resistance i.e. thermistor highly sensitive to temperature compared to RTD.	4. It is less sensitive to temperature compared to thermistor.
5.It has low operating temperature range compared to RTD i.e., minus 100 to plus 300°C.	5.It has-a wide operating temperature range i.e., minus 200 to plus 650°C.
6.Size of thermistors are small .	6. RTD's are relatively larger in size.
7.They are not costlier	7. They are costlier as compared to

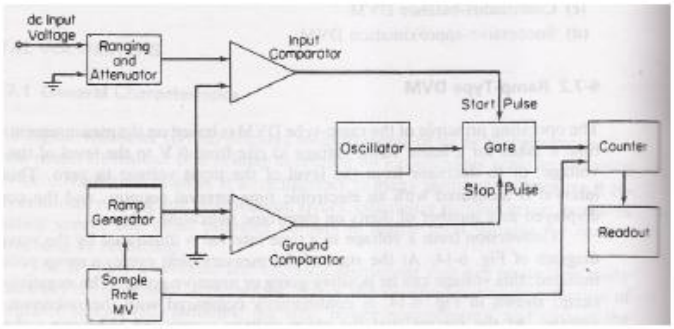
1 M for Each point

		as compared to RTD. 8.They have high self resistance. Thus, they require shielding cables to minimize interference problems. 9.Thermistors also provide an accuracy of ± 0.01°C. 10.They are widely used for dynamic temperature measurement.	thermistor. 8. They have low self resistance. 9. RTD's provide high degree of accuracy and long term stability. 10. They are used in laboratory and industrial applications.	
	e)	**Draw the circuit for 2 wire and 3 wire system of RTD.**		**4 M**
	Ans:	Diagram for 2 wire system of RTD  Diagram for 3 wire system of RTD  		**Each Diagram:2 M**
	f)	**Describe the working of capacitive transducer. State its two applications.**		**4 M**
	Ans:	Describe the working of capacitive transducer. State its two application. Diagram with Working: The capacitive Transducer is worked on the principle of change of capacitance which caused by i) change in overlapping area, ii) change in the distance d between the plates and iii) change in dielectric constant. This changes causes by the physical variables like displacement, force and pressure and change in dielectric constant caused by the change in media like liquid, gas level. $C = \epsilon A/d$ $= \epsilon_r \epsilon_0 A/d$		**Working:3 M & Application: 1/2 M**



Application: i) It is used for the measurement of force and pressure.
ii) It is used for measurement of humidity in gases.
iii) It is used for measurement of volume, density liquid level, weight etc.
(consider Any other relevant application)

Q.6		**Attempt any FOUR of following:**	**16 Marks**
	a)	**State any four applications of digital multimeter.**	**4 M**
	Ans:	Applications of digital multimeter: i) Voltage measurement. ii)Current Measurement. iii)Resistance Measurement. iv) Time and frequency measurement. v) Component testing by means of forward and reverse voltage, resistance. vi) Continuity test of circuits. *(consider any four application)*	**1M to each point**
	b)	**Draw the block diagram of digital voltmeter and explain its working.**	**4 M**
	Ans:	(Consider any type of DVM- Digital ramp type voltmeter/Integrated type DVM/Dual Slope type/Successive approximation type) Diagram:	Diagram: 2M & Working: 2M



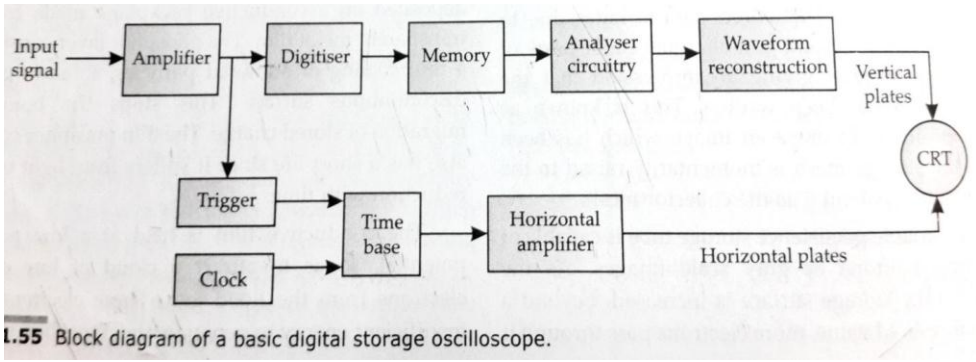
Ramp Type DVM

Working:

- The operating principle is to measure the time that a linear ramp takes to change the input level to the ground level or vice-versa. This time period is measured with an electronic time interval counter and the count is displayed as a number of digits on display.
- The ramp may be positive or negative. In this case a negative ramp has been selected.
- At the start of the measurement a ramp voltage is initiated [counter is reset to '0' & sample rate multivibrator gives a pulse which initiates the ramp generator]

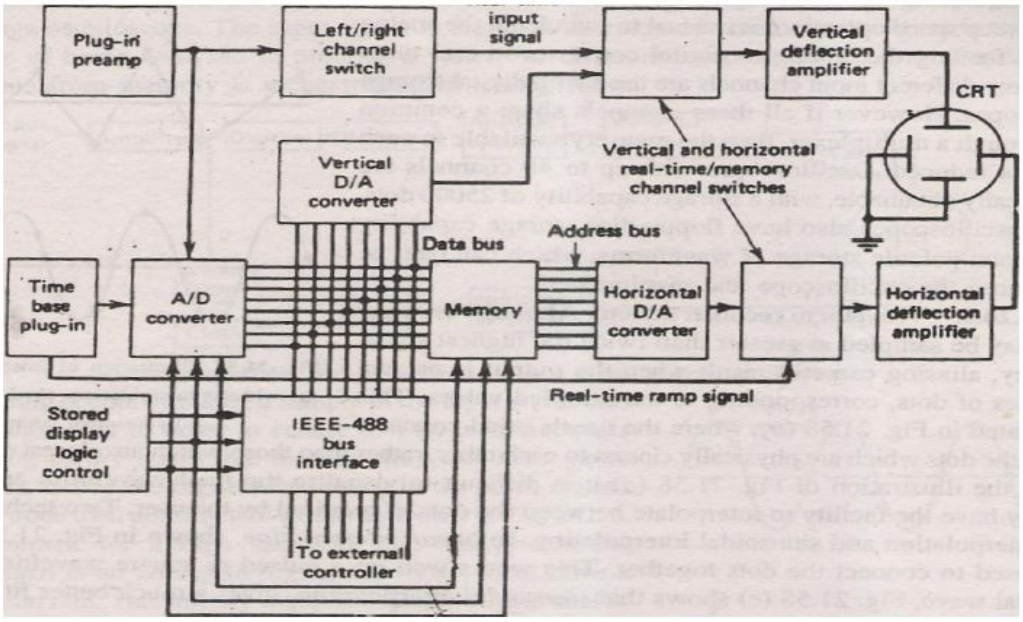
- The ramp generator is continuously compared with the voltage that is being measured.
- At the instant these two voltages become equal the input comparator generates start pulse which opens a gate.
- The ramp continues until the second comparator circuit senses that the ramp has reached zero value.
- The ground comparator compares the ramp with the ground, when the ramp voltage equals zero the ground comparator generates stop pulse. This pulse closes the gate.
- The time duration of the gate opening is proportional to the input voltage value.
- In the time interval between the start and stop pulses the gate opens and the oscillator circuit drives the counter.
- The magnitude of the count indicates the, magnitude of the input voltage which is displayed by the read out.
- Therefore the voltage is converted into time and the time count represents the magnitude of the voltage.

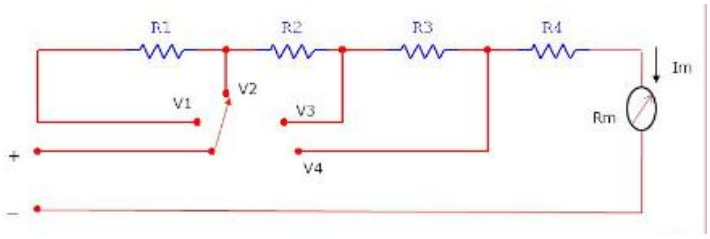
c)	**Draw block diagram of DSO and explain its working.**	**4 M**
Ans:	**Diagram:**	Diagram: 2M & Working: 2M

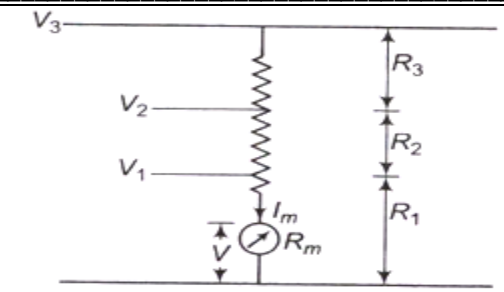


1.55 Block diagram of a basic digital storage oscilloscope.

OR



		Working: A digital oscilloscope digitizes the input signal so that all subsequent signals are digitized. A conventional CRT is used and storage occurs in electronic digital memory ● fig above shows a block diagram of a basic digital storage oscilloscope. ● The input signal is digitized and stored in memory in digital form .In this state it is capable of being analyzed to produce a variety of different information. ● To view the display on the CRT the data from memory is reconstructed in analog form. ● Digitizing occurs by taking a sample of the input waveform at periodic intervals. In order to ensure that no information is lost sampling theory states that the sampling rate must be at least twice as fast as the highest frequency in i/p signal. ● Many different i/p channels are used with digital storage oscilloscopes. however if all these channels share a common store , through a multiplexer , then the memory available to each channels is reduced ● Oscilloscopes with up to 40 channels are commercially obtainable with a storage capability of 25000 dots ● Several oscilloscopes also have a floppy disc storage capability to allow non-volatile storage of waveforms which can be later recalled into the oscilloscope and manipulated.	
d)		**Define four dynamic characteristics of instruments.**	**4 M**
Ans:		1. Speed of response: It is defined as rapidity with which a measurement system responds to changes in the measured quantity. 2. Measuring Lag: It is the retardation or delay in response of the measurement system to the changes in the measured quantity. 3. Fidelity: It is defined as degree to which a measurement system indicates changes in the measured quantity without any dynamic error. 4. Dynamic Error: It is the difference between true value of quantity (under measurement)changing with time.	1 Mark for each characteristics definition
e)		**Explain working of multirange voltmeter with neat diagram using PMMC meter movement.**	**4 M**
Ans:		**Diagram:**  Multirange voltmeter **OR**	Diagram: 2M & Working: 2M



Multi-range voltmeter for potential dividers

Explanation:
A PMMC Movement is converted into multirange DC Voltmeter by connecting 2 or more (series resistance) multiplier in series with the PMMC meter. The multiplier value is calculated by

$$R_S = (V/Im)-Rm= (m-1)Rm$$

The multiplier resistance is limits current flowing through meter to avoid meter from damage. Selection of different value of multiplier is done by selector switch or potential divider arrangement is used.

f)	**List and explain different types of errors.**	**4 M**
Ans:	Errors are classified as 1)Gross Error, 2)Systematic Error- i)Instrumental Error, ii)observational error, iii)environmental error, 3)Random Error **1)Gross Error:** It is the human mistakes in reading instruments and recording and calculating measurement results. It is caused by experimenter carelessness or equipment failure. It may be due to the person's bad habit of not properly remembering data at the time of taking down reading, writing and calculating, and then presenting the wrong data at a later time. This may be the reason for gross errors in the reported data, and such errors may end up in calculation of the final results, thus deviating results. **2)Systematic Error:** Systematic errors are of three types. i)Instrumental error-These errors arise due to three main reason i)Due to inherent shortcomings in the instrument ,ii)Due to misuse of Instruments and iii)Due to loading effects of instruments. ii)Environmental Error: These are due to conditions external to the measuring device including conditions in the area surrounding the instrument . These may be the effects of temperature , pressure, humidity, dust, vibrations or external magnetic or electrostatic field. iii)Observational Error: These are human factors involved in measurement . No two persons the same situation in exactly the same way. Error caused due to this is called Parallax error. **3) Random Error:** The error due to multitude of small factors which change or fluctuate from one measurement to another. These errors are randomly occurred so called as random errors.	**listing of error: 2marks, explanation: 2marks**