MODEL ANSWER
WINTER– 18 EXAMINATION

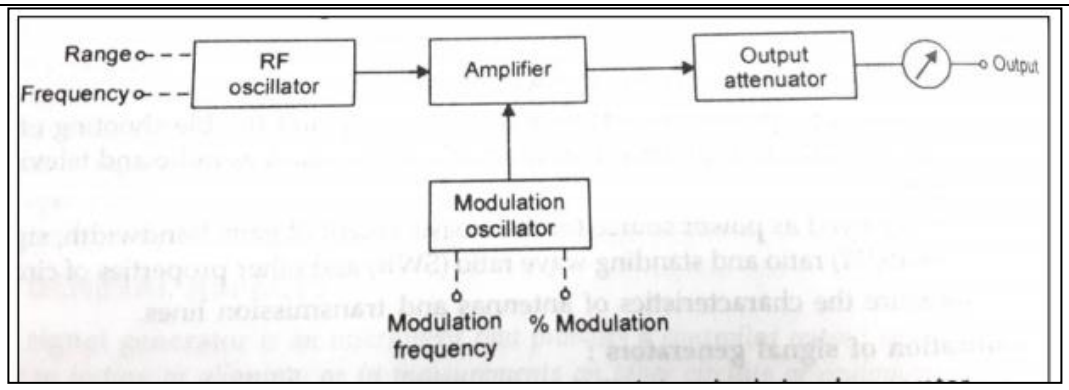
Subject Title: Electronic Instrumentation Subject Code:17435

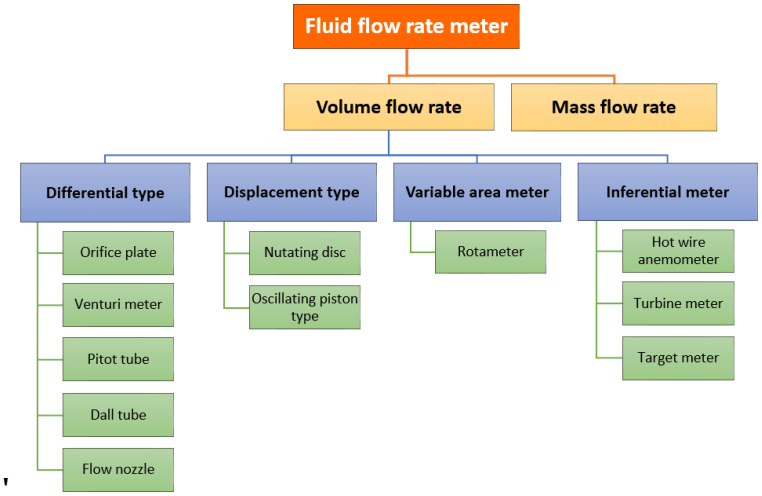
Important Instructions to examiners:

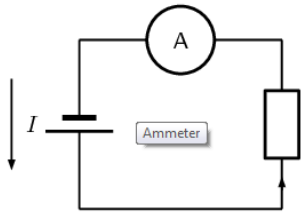
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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 anyequivalent 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.

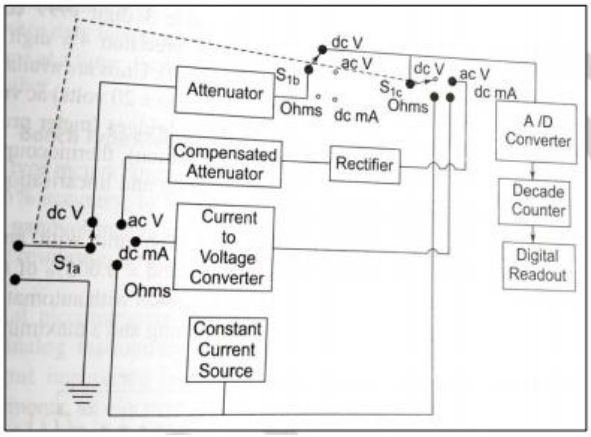
Q. No.	Sub Q.N.	Answer	Marking Scheme
Q.1	**(A)**	**Attempt any SIX :**	**12- Total Marks**
	a)	**State two examples of absolute instruments and two examples of secondary instruments.**	**2M**
	Ans:	**Examples of Absolute Instruments:** i) Tangent Galvanometer, ii) Absolute electrometer, and iii) Raleigh current balance. **Examples of Secondary Instrument: i)** Ammeter,ii) voltmeter, iii)ampere-hour meter, wattmeter.	**1M each**
	b)	**Compare active transducer and passive transducer on the basis of working principle and examples.**	**2M**
	Ans:	**Active Transducer** / **Passive transducer** 1.The active transducer does not use any external power source for producing the output / The passive transducer requires the additional energy source for working. 2.Additional source is not Require / 2. Additional source is Require 3. Solar Cell Tachogenerator, Thermocouple, Photovoltaic cell / 3. LVDT, Thermistor, Differential transformer, Photomultiplier tube,	**Any2 points 1M each**

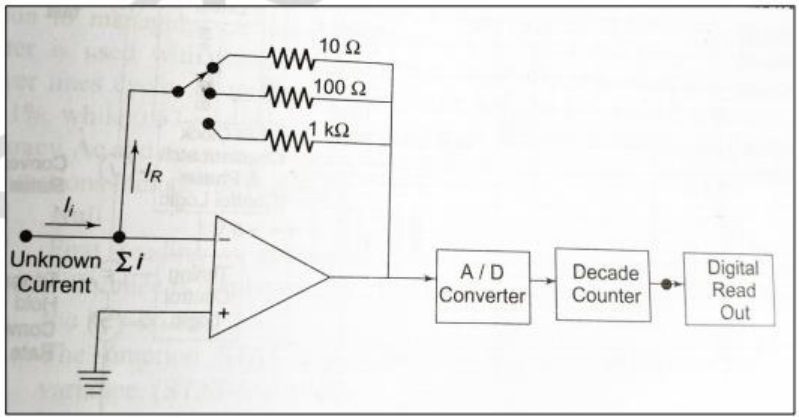
	c)	**State the need of wave analyzer. Also give types of wave analyzer.**	**2M**
	Ans:	Need of Wave analyzer: Mathematically any complex wave form is made up of a fundamental and its harmonics. It is often desired to measure the amplitude of each harmonic or fundamental individually. This can be performed by instruments called wave analyzer; this is the simplest form of analysis in the frequency domain. Types of Wave analyzer: • Frequency Selective Wave Analyzer • Super heterodyne Wave Analyzer	**1M need** **½ M types each**
	d)	**List any four applications of CRO.**	**2M**
	Ans:	**Applications of CRO:** 1. Examination of Waveform 2. Voltage measurement 3. Current measurement 4. Modulation Index measurement 5. Time measurement **6.** Phase measurement.	**Any 4 application ½ M each**
	e)	**List advantages of digital instruments.**	**2M**
	Ans:	Advantages of Digital Instruments: i) The digital instruments indicate the reading directly in decimal numbers. (ii) The reading may be carried to any number of significant figures by merely positioning the decimal point. (iii) The digital instrument requires smaller power. (iv) Its output is in digital form, so it is directly fed into the memory devices like the taperecorder, printers, floppy discs, and digital computer etc. (v)These instruments are free from observational errors, like a parallax and approximation errors. (vi) It has high resolution.	**Any 4 application ½ M each**

f)	**State any two important specifications of analog D.C. Voltmeter.**	**2M**
Ans:	i)Range: in terms of voltage ii)Movement type iii)Accuracy iv)Sensitivity v)Operating temp	**Any 2 application 1M each**
g)	**What is pt-100? Explain.**	**2M**
Ans:	Pt-100 is Resistance Temperature Detector. Pt Stands for Platinum material and 100 stands for 100Ωresistance at 0^0 centigrade.	**2M**
h)	**What is signal generator? Explain it's need.**	**2M**
Ans:	A signal generator is an electronic device that generates repeating or non-repeating electronic signals in either the analog or the digital domain. 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.	**Explain – 2M, Need - 2M**
B)	**Attempt any TWO :**	**8**
a)	**Describe with neat diagram the operation of R.F. signal generator.**	**4M**
Ans:	 **Operation:** • The RF oscillator is formed by an LC tank circuit. It generates a stable carrier • Frequency over any frequency range. The oscillator is an LC tank circuit, so the	**2M diagram** **2M Operation**

		• Frequency stability is limited. The frequency range is selected by connecting a switch to particular capacitor. • The amplitude modulation is provided by an internal sine wave generator. It may also be provided by an external source. • The modulation is done in a wide band amplifier. For modulation sine, square, • Triangular wave or pulse may be used. The output of wideband amplifier is connected to attenuator. • The required range of attenuation is selected and level of output signal can be controlled. The output meter is used to give an indicator of the output signal.	
	b)	**Give examples of any two materials used and any two applications of piezo-electric transducer.**	**4M**
	Ans:	Materials: 1) Natural Crystals- Quartz crystal, Rochelle salt 2) Synthetic Crystal-Barium Titanium Application: 1) Piezoelectric transducers also are used to generate ultrasonic vibrations for cleaning, atomizing liquids. 2) It is used to measure pressure 3) It is used in nonconventional energy source generation system.	**Example – 2M** **Applications 2M**
	c)	**Give-classification of flow measuring transducer.**	**4M**
	Ans:		**Classification- 4M**

Q 2		Attempt any FOUR :	16- Total Marks
	a)	**Describe different types and applications of thermistors.**	4M
	Ans:	Types : The **bead** form of the thermistor is smallest in shape, When bead is enclosed inside the solid glass rod to form **probes**. The **disc** shape is made by pressing material under high pressure with diameter range from 2.5 mm to 25mm. Applications of NTC: · For temperature measurement and control. · Temperature compensation. · Fluid flow measurement. Applications of PTC: · Temperature sensing in electrical motors and transformers protection. · Liquid level sensor. · To protect solid state fuse against excess current.	**Types Description-2M** **Application-2M**
	b)	**Describe any two specifications of analog d.c. ammeter. Draw the connection diagram of d.c. ammeter in electronics circuits.**	4M
	Ans:	 Ammeter connected in series in the circuit **Meter** Current **Face Size** 2.75in (69.85 mm) **Function** 0 to 25A **Backlighting Amperage** 16mA @ 12V DC, 20mA @ 24V DC **Meter Current** 1mA at full scale **Shunt Type** Internal **Weight** 0.25lb (0.11 kg)	**2M** **Any relevant Specification marks to be given** **Diagram-2M**

	c)	**Draw the block diagram of digital multimeter. Explain its working.**	**4M**
	Ans:	 **Explanation:** Digital meters offer high accuracy has high input impedance and are small in size. The output available is electrical for interfacing with external equipment in addition to a visual read out. All digital meters employ some kind of analog to digital converter and have a visible readout display at the converter output. DMM is basically a dc voltmeter. A basic digital multimeter DMM is made up of several A/D converters, circuitry for counting and an attenuation circuit. Alternating current is converted in to a dc by employing rectifiers and filters. A basic block diagram of DMM is shown in the figure above The current to voltage converter shown in the block diagram can be implemented with the circuit shown in the following figure.	**Block diagram - 2M** **Explanation - 2M**

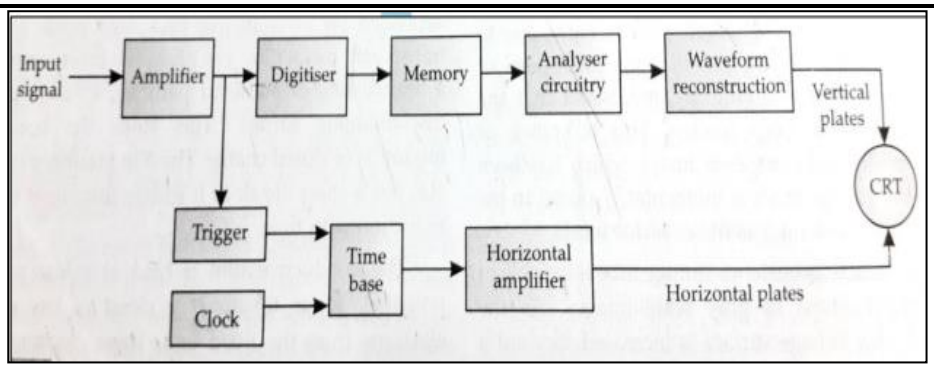


Optional *diagram*

For resistance measurement the meter includes a precision low current source that is applied across the unknown resistance again this gives a dc voltage which is digitised and read out as ohms.

d)	**Draw the block diagram of DSO. List it's application.**	**4M**

Ans:

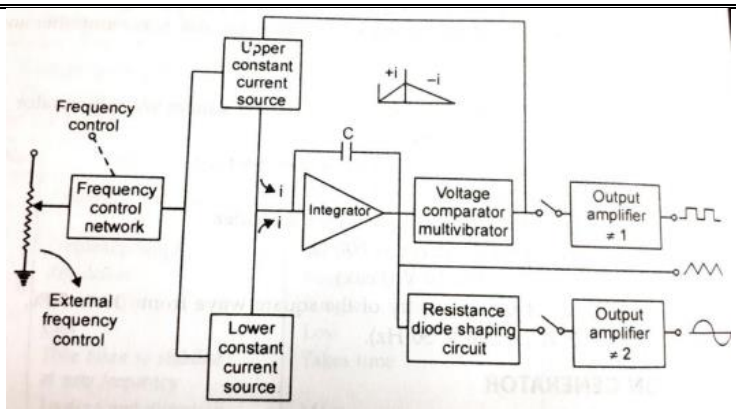


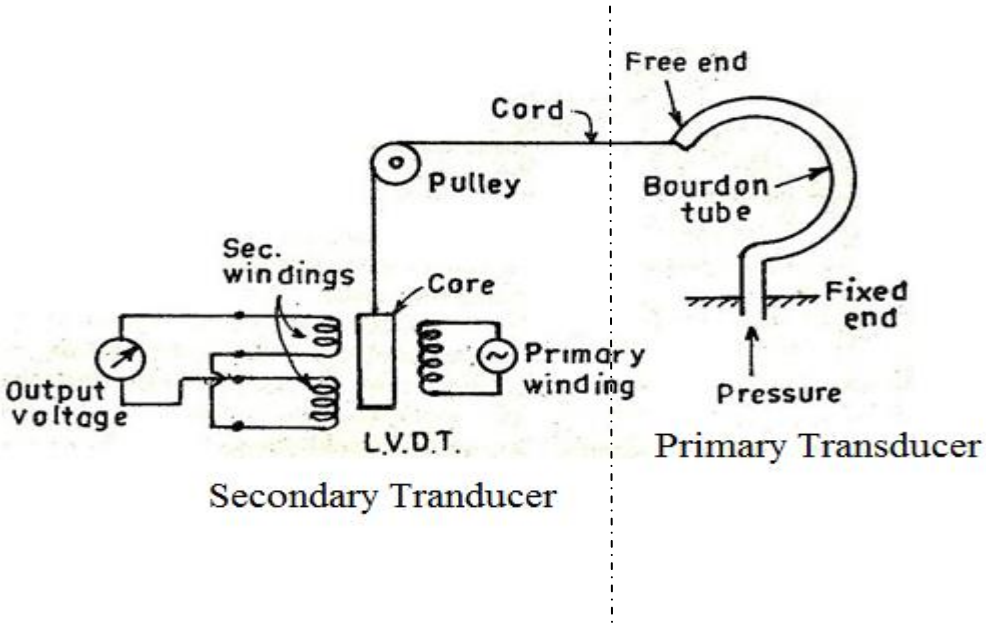
Block Diagram-2M

Applications:

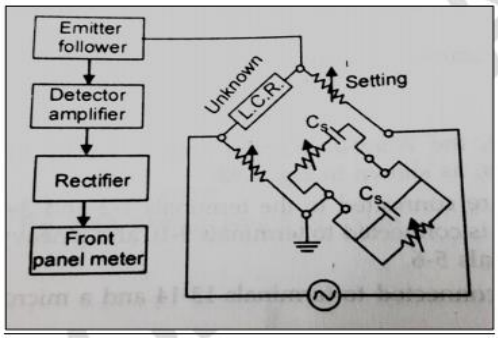
- The DSO is used to give the visual representation for a target of radar such as aeroplane, ship etc.
- The DSO can be used to check the faulty components in various circuits.
- It can be used in medical field.
- The DSO can be used to measure ac as well as dc voltages and current.
- It can be used to analyze TV waveforms.
- The digital storage oscilloscope (DSO) is used to observe the radiation pattern generated by the transmitting antenna oscilloscope.
- The DSO used to save signals, so that it can be compared to or processed.
- The DSO can be used to measure the inductance, capacitor.
- It can be used to measure frequency, time period, time interval between signals etc.

any two Each 1M

		• It can be used to observe the V-I characteristics of diodes, transistors.	
	e)	**Draw the block diagram of function generator. Explain.**	**4M**
	Ans:	 **Explanation** • A function generator produces different waveforms of adjustable frequency. The common output waveforms are the sine, square, triangular and saw tooth waves. The frequency may be adjusted from a fraction of a hertz to several hundred kHz. • The block diagram of a function generator is illustrated above. Usually the frequency is controlled by varying the capacitor in the LC or RC circuit. • In this instrument the frequency is controlled by varying the magnitude of current which drives the integrator. This instrument produces sine triangular and square wave 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. • 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 7 switches on the upper current source. • The output of the integrator is a triangular waveform whose frequency is determined	**Block-2M** **Explain-2M**

		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)	**Explain primary and secondary transducer with the help of suitable diagram.**	**4M**
	Ans:	**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.  	**Primary -1 M** **Secondary -1 M** **2M - Diagram**
Q.3		**Attempt any FOUR:**	**16- Total Marks**
	a)	**List any four static characteristics and any four dynamic characteristics of electronic instruments.**	**4M**
	Ans:	**Static Characteristics:** Accuracy – the degree of exactness (closeness) of measurement compared to the expected	**Static chara- 2M**

		(desired) value. • Resolution – the smallest change in a measurement variable to which an instrument will respond. • Precision – a measure of consistency or repeatability of measurement, i.e successive reading do not differ. • Sensitivity – ratio of change in the output (response) of instrument to a change of input or measured variable. • Expected value – the design value or the most probable value that expect to obtain. • Error – the deviation of the true value from the desired value. **Dynamic Characteristics**: • Dynamic error-The difference between the true and measured value with no static error. • Lag – delay in the response of an instrument to changes in the measured variable. • Fidelity – the degree to which an instrument indicates the changes in the measured variable without dynamic error (faithful reproduction).	**Dynamic chara-2M**
	b)	**A basic d'Arsonval meter with an internal resistance of R_m = 100Ω and full scale deflection current Im = 1mA is to be converted into d.c. voltmeter with the range of (0-10) V. Find the valve of series resistance.**	**4M**
	Ans:	Given: Rm=100Ω Im= 1mA V=10V Rs = $\frac{V}{Im}$ – Rm = $\frac{10}{1mA}$ – 100 =9900 Ω =9.9k Ω So the value of Rs=9.9k Ω	**4M**
	c)	**Explain with neat block diagram of digital LCR meter.**	**4M**
	Ans:		**Block Dia-2M**



Explain -2M

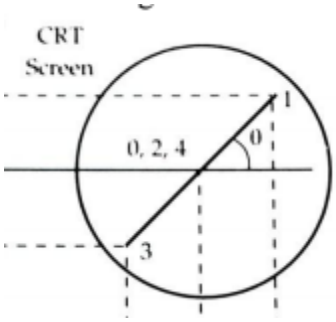
Explanation:

- The above figure shows the typical LCR meter. It can give direct reading of the value of the component under measurement.
- It has switching arrangement for the purpose of the measurement of L,C and R.
- An internal oscillator generates an Ac signal of 1 KHz frequency.
- It is used for exciting bridge for Ac measurement. Provision is also given to excite the bridge with an external oscillator. The oscillator excites the bridge.
- The output from the bridge is fed to the detector amplifier through an emitter follower circuit. The amplified output from the amplifier is rectified using shunt diode and then fed to the meter.
- This enables the meter to always move in one direction for all Ac measurement.
- For DC resistance measurement separate provision is available to excite the bridge with DC voltage.
- For Ac or DC operation a selector switch is provided to the meter.
- To improve the range of the measurement multipliers are provided. High precision metal film resistors of good temperature stability are used in multiplier stage.
- The multiplier range is provided in decade steps. Any variation in the value multipleresistor either due to aging or temperature will affect the accuracy of measurement.

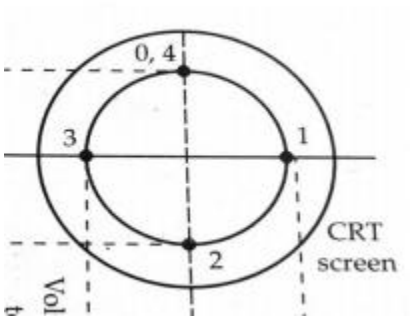
d)	**Describe with neat sketch Lissajous pattern for phase measurement.**	**4M**
Ans:	• When two signals are applied simultaneously to an oscilloscope one to the horizontal channel and other to the vertical channel, the resulting pattern is a lissajous figure that shows a phase difference between the two signals. • when two sinusoidal voltages of equal frequency which are in phase with each otherare applied to the horizontal and vertical deflection plates , the pattern appearing	**Describe 2M** **Patterns 2M**

on the screen is a straight line as is clear from the figure below**.**

i)If the Lissajous figure is a **straight line** with an inclination of 45∘45∘ with positive x-axis, then the **phase difference** between the two sinusoidal signals will be 0∘0∘. That means, there is no phase difference between those two sinusoidal signals.

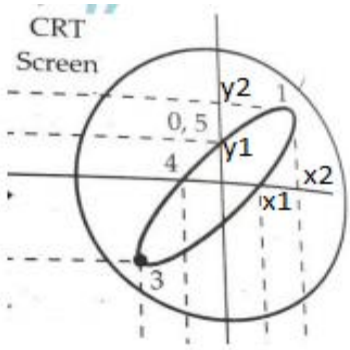


ii) If the Lissajous figure is in **circular shape**, then the phase difference between the two sinusoidal signals will be 90∘90∘ or 270∘270∘.

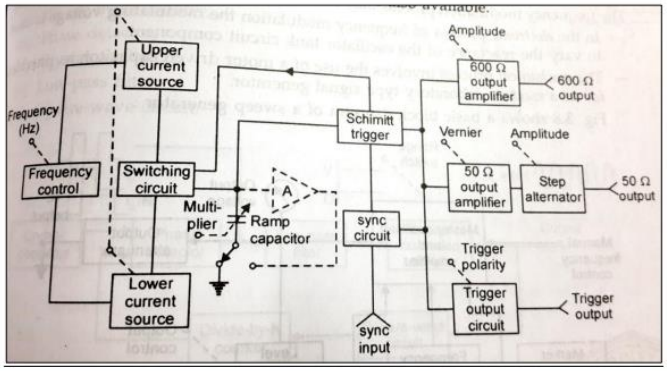
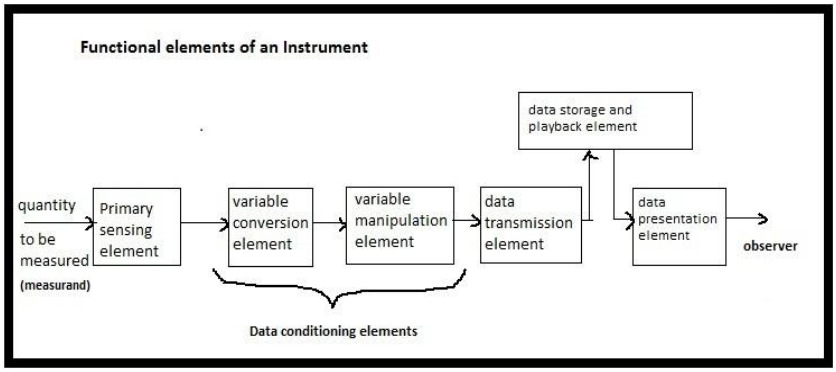


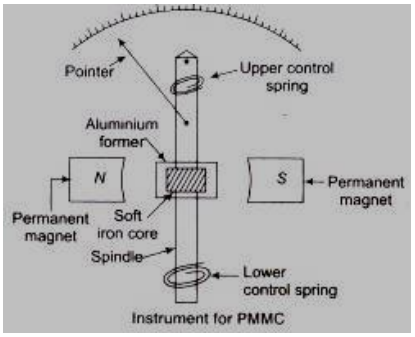
iii) the phase difference between the two sinusoidal signals by using formulae, when the Lissajous figures are of **elliptical shape**

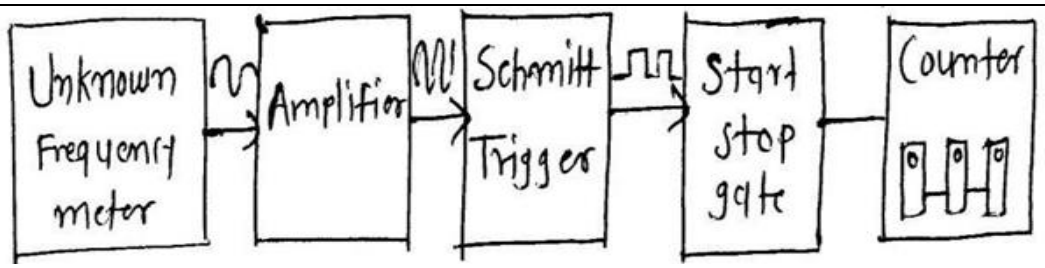
$$\phi = \sin^{-1}\left(\frac{x_1}{x_2}\right) = \sin^{-1}\left(\frac{y_1}{y_2}\right)$$



e)	**Draw the block diagram of pulse generator.**	**4M**

	Ans:	**Diagram:**  	**Block Dia-4M**
f)	**Draw the block diagram of Instrumentation system. Explain the function of each block.**		**4M**
	Ans:	**Diagram:**  **Explanation:** • Primary sensing & Transduction Element: It is a detector which responds to physical phenomenon or a change in physical equipment. And transduction element transforms output of sensing element in electrical signal or in compatible signal. • The compatible or electrical signal is the processed by intermediate means or signal condition unit as per requirement of output devices. So as Data get conditioned, filtered and stabled here at this stage. • Data transition Element: The data after conditioning has to be conveyed to the intelligent system so as either can be monitored or recorded, or displayed.This is the function of transmission element which transfer this data in appropriate format. • Data presentation Element: this is the final stage og the system. It consists of either pointer-scale, or digital display, or recorder or printer.	**Block dia-2M** **Explain -2M**

Q.4	**A)**	**Attempt any FOUR :**	**16- Total Marks**
	a)	**With neat sketch, explain working principle and construction of PMMC.**	**4M**
	Ans:	**Diagram:-**  Instrument for PMMC **Construction**:- The moving coil is wound with many turns of copper wire. The coil is mounted on a rectangular aluminum former which is pivoted on jeweled bearings. The coils move freely in the field of a permanent magnet. **Working Principle:-** • When current passes through the coil a deflecting torque is produced. This deflecting torque is produced due to interaction between magnetic field produced by permanent magnet and magnetic field produced by moving coil. • Due to this torque the coil deflects and this deflection is proportional to the current flowing through the coil. The pointer attached to the coil indicated the magnitude of quantity being measured. • The another torque is developed by the hair spring known as controlling torque. This torque help to stabilize the pointer. • The pointer becomes stable at equilibrium, this is possible only when the controlling torque becomes equal to the deflecting torque.	**Skech-2M** **Construction--1M** **Working Principle-1M**
	b)	**Draw the block diagram of digital frequency meter. Explain the function of each block.**	**4M**
	Ans:	**Diagram:-**	**Block dia-2M**



Working:-

- **Amplifier** -: The signal whose frequency is measured is first amplified. The output of amplifier is applied to the Schmitt trigger.
- **Schmitt trigger**: Schmitt trigger converted the signal in to square wave having fast rise and fall times. The square wave is then differentiate 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, when the gate is open input pulse are allowed to pass through it. A counter will count these pulse. When gate is closed input pulse are not allowed to pass through the gate. The counter will now stop counting.
- **Counter and display**- The number of pulse during the period gate is open and counted by the counter. If this interval between start and stop condition id known. The frequency of unknown signal is measured.

  F=N/t

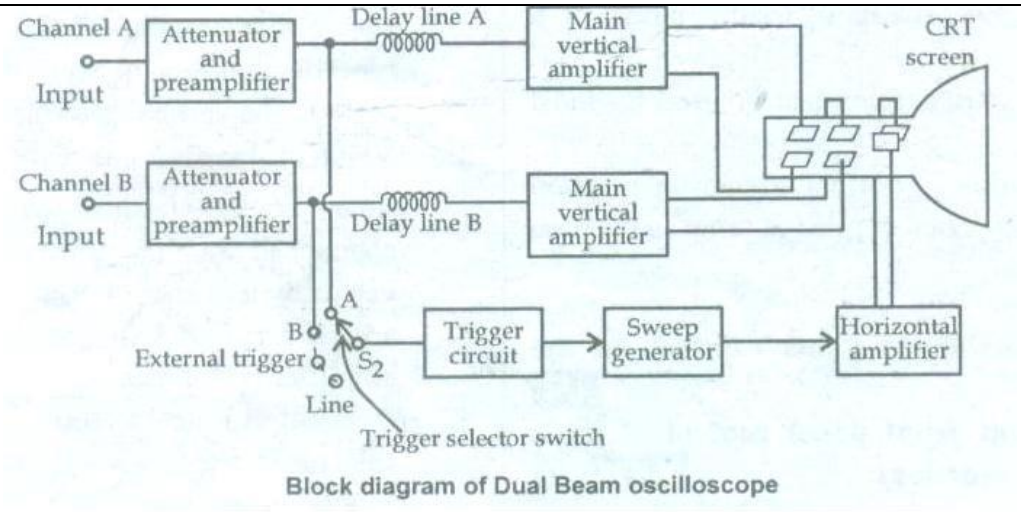
  F= unknown frequency

  N= number of counts displayed by counter.

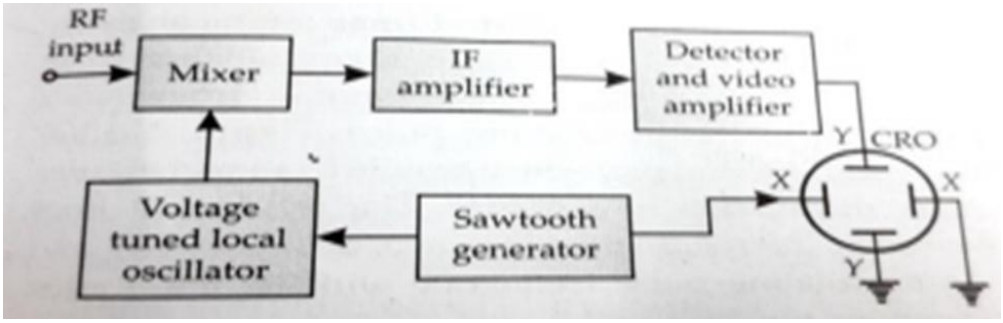
  t= time interval between start and stop condition of the gate.

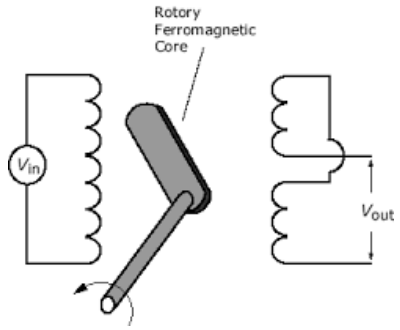
Function-2M

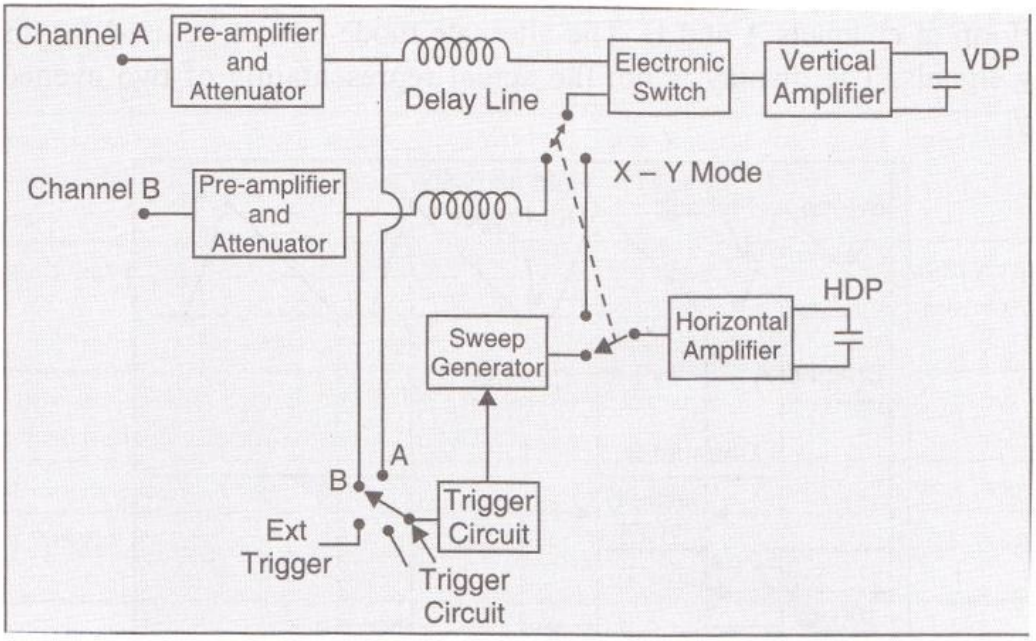
	c)	**Draw the block diagram of dual beam dual trace oscilloscope**	**4M**
	Ans:	**Diagram:**	**Block dia-4M**



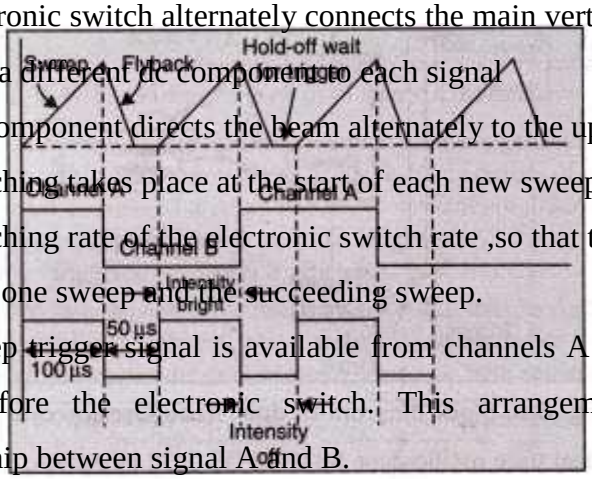
Block diagram of Dual Beam oscilloscope

	d)	**Describe with neat block diagram operation of spectrum analyzer.**	**4M**
	Ans:	**Diagram:-**  **Working**: • Referring to the block diagram of the basic spectrum analyzer, 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 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.	**Blockdia-2M** **Operation-2M**

	e)	**Illustrate the working of RVDT as a displacement transducer.**	**4M**
	Ans:	**Diagram:-**  **<u>Working of RVDT :-</u>** • 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 grater this angular displacement, the grater 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.	**Diagram-2M** **Working-2M**
	f)	**Give the classification of thermocouples based on material used and temperature range.**	**4M**
	Ans:	**<u>Classification of Thermocouple:-</u>** **Type** / **Material** / **Temperature ranges** J type / Iron-constant / -196^0 c to 760^0c K type / Chromel –Alumel / -200^0c to 1260^0c T type / Copper –Constant / -190^0c to 400^0c R type / Pt(87%) Rh(13)-Platinum / -18^0c to 1400^0c S type / Pt (90%) Rh(10%)-Pt / -18^0c to 1760^0c	**Any 4 = 1 M each**

			E type	Chromel- constant	-196^0c to 999^0 c		
Q.5		**Attempt any FOUR :**					**16- Total Marks**
	a)	**Explain with neat diagram the operation of single beam dual trace oscilloscope.**					**4M**
	Ans:	**Diagram:**  **<u>Working</u>**: A mode control system (s1) enables the electronic switch to operate in two modes Alternate and chop mode and x-y mode. **<u>Alternate mode:</u>** When the switch (s1) is in alternate position, the electronic switch feeds each signal alternatively to the vertical amplifier.					**Diagram-2M** **Operation-2M**

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.

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.

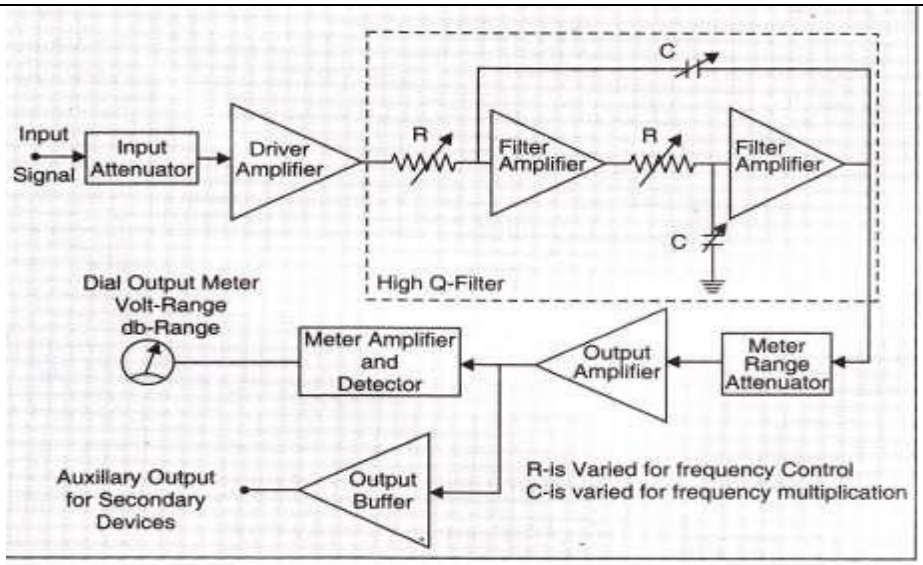
If the chopping rate is slow, the continuity of the display is lost and it is better to use the alternate mode of operation.

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.

	b)	**Describe with neat block diagram the operation of frequency selective wave analyzer.**	**4M**
	Ans:	**Diagram:-**	**Block dia-2M**

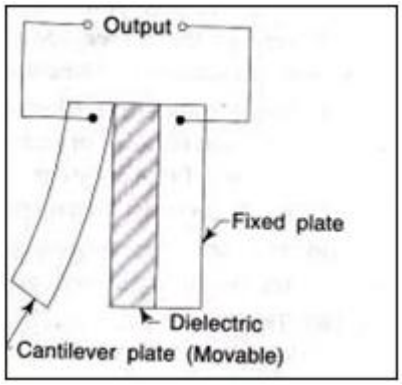
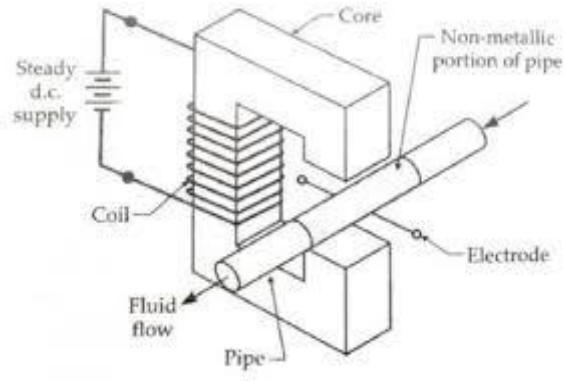


Operation:-

- The wave analyzer consist of a very a narrow pass-band filter section can be tuned to a particular frequency.
- The complex wave to be analyzed is passed through an adjustable attenuator which serves as a range multimeter 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 high-Q filter is a low pass filter which allows the frequency which is selected to pass and reject all others.
- The magnitude of the selected frequency is indicated by the meter and the filter section identifies the frequency of the component.
- 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 selected signal output from the final amplifier stage is applied to the meter circuit & un-tuned buffer amplifier.
- The main function of the buffer amplifier is to drive output devices.

Operation-2M

	c)	**Describe construction and working of capacitive transducer with suitable diagram.**	**4M**

	Ans:	**Diagram:**  **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 plat , decreasing the distance between the two plate. 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 the 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.	**Diagram-2M** **Construction-1M** **Working-1M**
	d)	**Describe the working of electromagnetic flow meter with suitable diagram.**	**4M**
	Ans:	**Diagrame:-**  **Working :-** The operation of this type of flowmeter is based on Faraday's law of electromagnetic induction. The law state that whenever the conductor moves through a magnetic field,	**Diagram-2M** **Working-2M**

		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.	
	e)	**Define unit. Give two examples of each of base unit, supplementary unit and derived units.**	**4M**
	Ans:	**Unit:-** The result of a measurement of a physical quantity must be defined both in kind and magnitude. The standard measure of each kind of physical quantity is called a Unit. **Base Unit:(any two)** Length, Mass, Time, Intensity of electric current, Thermodynamic Temperature, Luminous intensity, Amount of substance **Supplementary unit: (any two)** Plane angle, Solid angle **Derived units: (any two)** Area, Volume, Frequency, Density, Velocity, Acceleration, Force, Pressure, Viscosity, Power, Resistance, capacitance, Inductance, Work, Energy, Quantity of heat	**1M** **1M** **1M** **1M**
	f)	**What are requirements of shunt resistance in ammeter?**	**4M**
	Ans:	• 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.	**4M**
Q.6		**Attempt any FOUR:**	**16- Total Marks**
	a)	**Define error. List source of error in measurement system.**	**4M**
	Ans:	**Definition of Error**:- [redacted] An error is the deviation of the true value from the desired value. **Sources of error:-** **Gross Errors:-** The gross error occurs due to the human mistakes in reading or using the	**Defination – 2M**

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.

List- 2M

b) Compare analog instruments and digital instruments on the basis of accuracy, resolution, working principle and examples — **4M**

Ans:

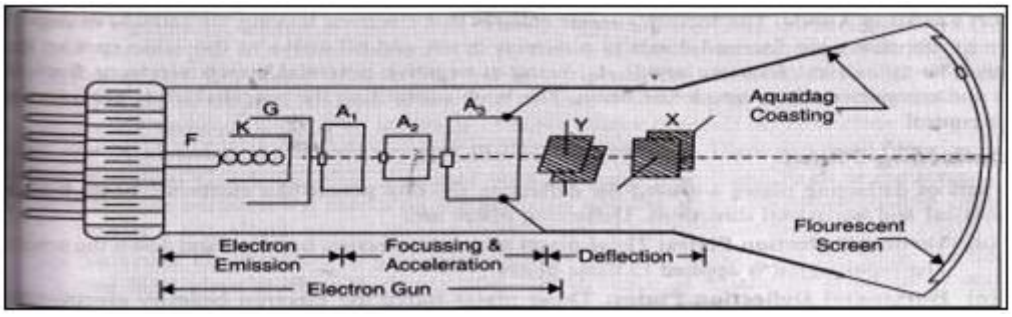
Analog instruments	Digital instruments
Accuracy is less	Accuracy is more
Resolution is less	Resolution is more
Displays analog signal	Displays digital signal
Examples: PMMC instruments, DC voltmeter, DC ammeter	Examples: Logic analyzer, digital analyzer

Any 4 points – 1M each

c) Draw neat and labeled diagram of internal structure of CRT. — **4M**

Ans:

Diagram:

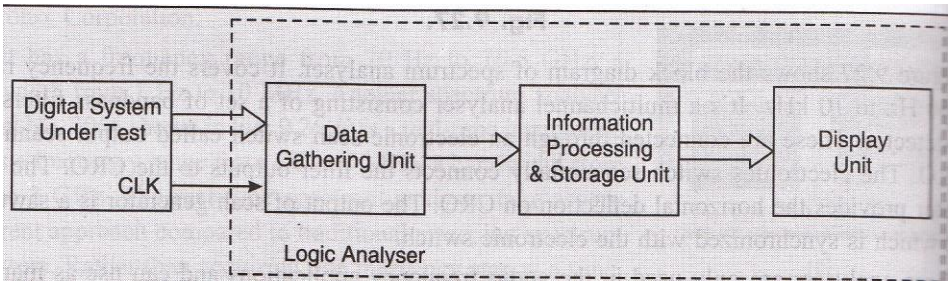


2M diag. 2M labeling

d) Describe working principle of Logic Analyzer with neat diagram. — **4M**

Ans:

Diagram:-



2M

Working Principle:-

2M

		• A block diagram of a typical logical analyzer. It has a data gathering unit information processing and storage unit and a display unit. • The data gathering unit has ➢ A pod slots for carrying data from the digital system under test to the logic analyzer. ➢ 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. • The display unit is a cathode ray tube (CRT) that displays the command menu for the operator and also displays the output data.	
	e)	**List any eight front panel controls of CRO.**	**4M**
	Ans:	**Front panel controls of CRO (any eight)** 1. POWER ON 2. INTENSITY 3.FOCUS 4. TIME BASE 5.TIME BASE VARIABLE 6. HOLD-OFF 7.⇔ POSITION/x5 8.LEVEL 9. AUTO/NORM 10. INT/EXT 11. LINE 12.TV 13. CH1/CH2 14. +/ 15. HF Rej 16. ac/dc 17. SWP/X-Y 18. 0.2, 1KHz 19. ⇳ Positions 20.ac/dc/gnd 21. EXT-TRIG 22.INPUT BNC CH1/Y (CH2/X) 23.TRACE 24.CH1/CH2 ATTENUATOR	**½ M each**
	f)	**Define the term temperature and flow. State their units.**	**4M**
	Ans:	**Temperature:-**It is the degree or intensity of heat present in a substance or object. **Units of Temperature:** Celsius or centigrade (°C) Fahrenheit (°F) Kelvin (°K). **Flow:-**Flow is defined as fluid in motion. Flow may be of Gas or Liquids. **Units of Flow: (any two)** Tonnes/hour Kg/minute litres/hour litres/minute m3/hour Nm3/hour	**1M** **(any two) - 1M** **1M** **1M**