WINTER – 19EXAMINATIONS

Subject Name: Electronics Instruments & Measurements Model Answer **Subject Code: 22331**

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in themodel answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may tryto assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given moreImportance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in thefigure. 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 constantvalues 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 five of the following:**	**10-Total Marks**
	a)	**Define the term "measurement."**	**2M**
	Ans:	Measurement is an act of comparison between the quantity whose magnitude is unknown and predefined standard.	**2M**
	b)	**Write the specifications of analog multimeter.**	**2M**
	Ans:	**Specification of analog multimeter: (any two)** • DC Voltage: 2.5V, 10V, 25V, 100V, 250V, 1000V • AC voltage: 10V, 25V, 100V, 250V, 1000V • DC Current: 50µA, 1mA 10mW, 100mA • Resistance: R, 100R, 10 000R • Sensitivity: 2000-8000ohms per volts (AC) • Accuracy: +/-3-4% of full scale • Frequency: rated accuracy to 50KHz • Battery: 9V • Operating temperature: 25^0C-50^0C • Front panel controls: range switch, ohms adjust, TR checker	**1M Each**
	c)	**State the working principle of PMMC.**	**2M**
	Ans:	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	**2M**

		magnet and magnetic field produced by moving coil as per faraday's law of electromagnetic induction. 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.	
	d)	**Define resolution and accuracy of digital instrument.**	**2M**
	Ans:	**Resolution:** The number of digit positions used in digital meter detrmines the resolution. If n= number of full digits then resolution is R=$\frac{1}{10^n}$. **Accuracy:** The degree of exactness is called Accuracy. The expected accuracy of digital meter is 0.001% reading.	**1M Each**
	e)	**State the need of function generator.**	**2M**
	Ans:	**The need of function generator** • Function generators have a variety of applications such as checking the stage again, frequency response and alignment in receivers and in wide range of other electronic equipment. • To provide variety of waveforms fot tesiting electronic circuits at low power.	**1M for each point**
	f)	**Write the specifications of spectrum analyzer.**	**2M**
	Ans:	**Specification of spectrum analyzer**: (any two) • Maximum frequency range • Data acquisition bandwidth • Power source • Frequency accuracy • Phse noise specification • Amplitude accuracy • Resolution **OR** **Any other relevant specification is to be considered**	**1M Each for any 2 points**
	g)	**List different types of AC and DC bridges.**	**2M**
	Ans:	**(Any two each)** **DC Bridge:** • Wheatstone bridge • KelvinBridge **AC bridge:** • Hay brige • Maxwell Bridge. • Schering Brigde •	**½ M Each for each type**
Q.2		**Attempt any THREE of the following:**	**12-Total Marks**
	a)	**Describe the different types of errors accurs in measurement with one example each.**	**4M**
	Ans:	1. **Gross Error -** These errors are mainly human mistakes in reading instruments and recording and calculating measurement results.These can be avoided by great care should be taken in reading and recording the data and two, three or more readings	**1M Each(Any four)**

should be taken for quantity under measurement.
Example: Operator is reading pressure gage 1.01N/m^2 as 1.10N/m^2.

2. **Systematic Error** – These types of error are divided into three categories – Instrumental Errors , Environmental Error and Observational Error .Instrumental error is due to inherent shortcomings in the instrument, due to misuse of the instrument and due to loading effects of instrument.
   Example: Analog Meter has smallest reading on scale 0.5A so current less than 0.5A cannot be measured on it.
3. **Environmental errors** are due to conditions external to the measuring device including conditions in the area surrounding the instrument. These may be effect of temperature,pressure, humidity, dust, vibrations or of external magnetic or electrostatic fields.
   Example: unpredictable fluctuations in line voltage, temperature, or mechanical vibrations of equipment.
4. **Observational error** is nothing but parallax error. As the pointer of analog measuring instruments rests slightly above the surface of scale it causes parallax error. To minimize parallax error meters are provided with mirror.
   Example: parallax in reading a meter scale i.e errors in judgment of an observer when reading the scale of a measuring device to the smallest division.
5. **Random Error** – These errors are due to unknown causes which are not determinable. Such errors those remain after gross and systematic errors have been substantially reduced.Random errors are statistical fluctuations (in either direction) in the measured data due to the precision limitations of the measurement device. Random errors usually result from the experimenter's inability to take the same measurement in exactly the same way to get exact the same number.
   Example: a stop watch to measure the time required for ten oscillations of a pendulum.

b) **Explain with sketches the working of ohm meter.** **4M**

Ans: Ohmmeter measure appropriate value of Resistance. There are two types of ohmeter: 1.series type 2. Shunt type

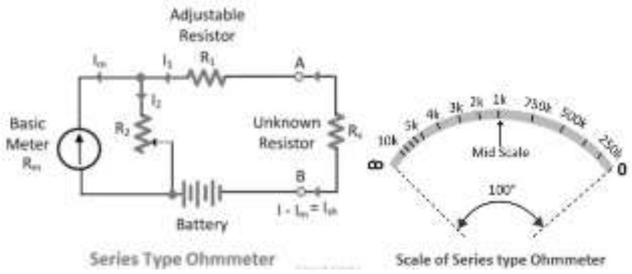
2M (Explanation)

Series ohm meter:

In series ohmmeter, the measuring resistance component or circuit is connected in series with the meter.

- The value of resistance is measured through the d'Arsonval movement connected in parallel with the shunt resistor R_2.
- The parallel resistance R_2 is connected in series with the resistance R_1 and the battery.
- The component whose resistance is used to be measured is connected in series with the terminal A and B.
- When the value of unknown resistance is zero the large current flow through the meter.
- In this condition, the shunt resistance is adjusted until the meter indicates the full load current.
- For full load current, the pointer deflects towards zero 0 ohms.
- When the unknown resistance is connected in series with the circuit and if their resistance is high, then the pointer of the meter deflects toward the left. And if the resistance is low, then pointer deflects toward the right.

The circuit diagram of the series ohmmeter is shown in the figure below.



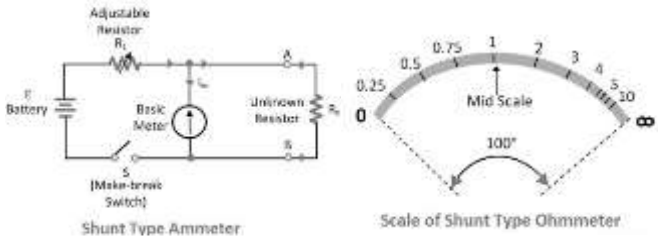
2M(Diagram)

OR

Shunt type ohmmeter: The meter in which the measuring resistance is connected in parallel with the battery is known as the shunt ohmmeter. It is mainly used for measuring the low-value resistance.

- The battery (E), basic meter (R_m) and the adjustable resistance are the main components of the shunt ohmmeter. The unknown resistance is connected across terminal A and B.
- When the value of unknown resistance is zero the meter current becomes zero. And if the resistance becomes infinite (i.e., the terminal A and B are open) then the current passes through the battery and the pointer shows the full-scale deflection toward left.
- The shunt type ohmmeter has the zero mark (no current) on the left of the scale and the infinity mark on their right side.

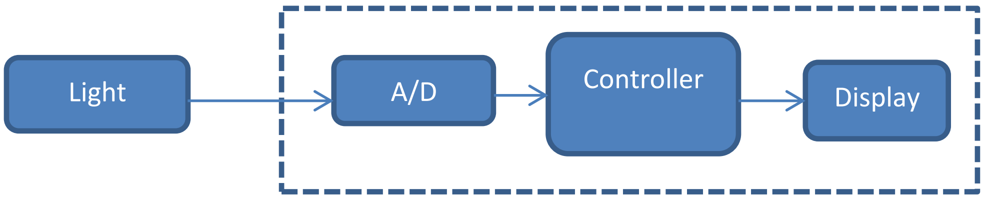
The circuit diagram of the shunt ohmmeter is shown in the figure below.



c) Describe with sketches the working of lux meter. **4M**

Ans: Digital LUX Meter: **2M**

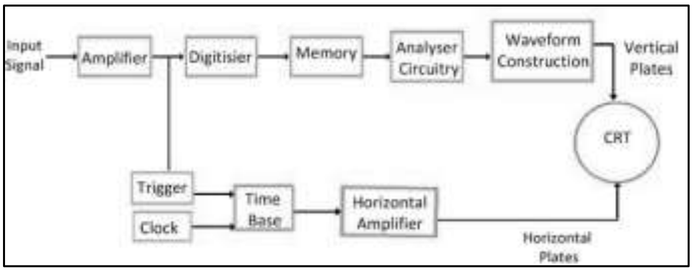
Diagram:

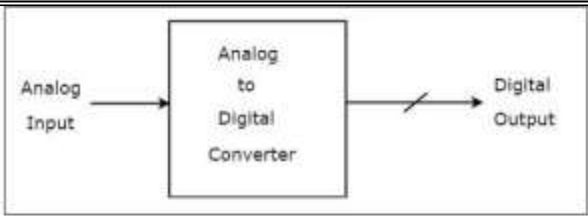


Explanation: **2M**

- A lux meter is a device for measuring brightness. It specifically measures the intensity with which the brightness appears to the human eye. This is different than measurements of the actual light energy produced by or reflected from an object or light source.

- A lux meter works by using a photodiode to capture light. The meter then converts this light to an electrical current. Measuring this current allows the device to calculate the lux value of the light it captured.
- The lux light meter's calculation of luminance is done by using the Point Source process. The measure of the lux light meter varies depending on the light's intensity and distance. If a point source has no reflections, a portion of the produced light reaches a surface.

	d)	**Suggest an instrument to measure unknown frequency above 5 MHz and store the result. Justify it.**	**4M**
	Ans:	**Digital storage oscilloscope** is used to measure unknown frequency above 5MHz and store the result . Digital Storageoscilloscope analyse and store the signal. It provides numerical anlysis of stored waveform as well as visual display. The block diagram is shown below. **Diagram:** 	**2M** **2M**
Q.3		**Attempt any THREE of the following:**	**12-Total Marks**
	a)	**Convert the PMMC movement into a DC ammeter of the range 0 to 100 MA.**	**4M**
	Ans:	**Note: since R_m and I_m are not given, any appropriate assumptions of values should be considered** Let, R_s = Shunt resistance R_m = Internal resistance of movement I = total load or circuit current to be measured $$R_{sh} = \frac{I_m R_m}{I - I_m}$$ Consider I_m= 1mA and R_m=100Ω R_s=(1mA*100)/100mA-1mA R_s=(1mA*100)/99mA **R_s=1.01Ω**	**4M**
	b)	**Describe with sketches the working of Digital frequency meter.**	**4M**
	Ans:	An Analog to Digital Converter **(ADC)** converts an analog signal into a digital signal. The digital signal is represented with a binary code, which is a combination of bits 0 and 1. The **block diagram** of an ADC is shown in the following figure :	**2M diagram**



2M

Explanation:

An Analog to Digital Converter **(ADC)** consists of a single analog input and many binary outputs. In general, the number of binary outputs of ADC will be a power of two.

If the ADC performs the analog to digital conversion directly by utilizing the internally generated equivalent digital (binary) code for comparing with the analog input.

c)	**Explain how CRO is used for measurement of frequency and phase.**	**4M**

Ans: **Frequency Measurement**: — **2M each**

Lissajous pattern can be used for measurement of unknown frequency. Initially switch ON the CRO on X-Y mode. The unknown frequency signal is applied to the vertical deflection plates of the CRO (Channel Y) and standard known variable frequency signal is applied to the horizontal deflection plates (channel X). The frequency of the standard source is adjusted now, until a circular or elliptical pattern appears on the CRT screen. When such a pattern is observed on the screen, it indicates that the two frequencies are equal.

fy = number of horizontal tangents

fx= number of vertical tangents

Frequency Ratio= number of horizontal tangents/ number of vertical tangents

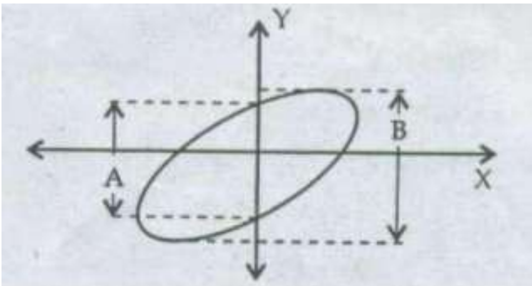
Phase Measurement:

The phase measurement can be done by using Lissajous figures.

The CRO is set to operate in the X- Y mode, then the display obtained on the screen of a CRO is called Lissajous pattern, when two sine waves of the same frequency are applied to the CRO. (One vertical and one horizontal deflection plates).

Depending on the phase shift between the two signals, the shape of the Lissajous pattern will go on changing. The phase shift is given by,

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



2M (Lissajous pattern)

d)	**Describe the working of Maxwell bridge.**	**4M**

Ans: **Diagram:** — **2M diagram**

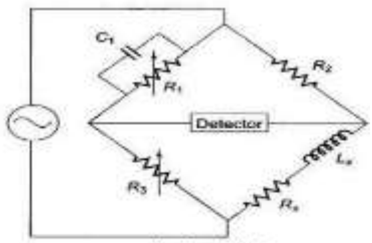


Fig: Maxwell bridge

2M explanati

In such type of bridges, the value of unknown resistance is determined by comparing it with the known value of the standard self-inductance. The connection diagram for the balance Maxwellbridge is shown in the figure below.

Let, L1 – unknown inductance of resistance R1.
L2 – Variable inductance of fixed resistance r1.
R2 – variable resistance connected in series with inductor L2.
R3, R4 – known non-inductance resistance

$$L_1 = \frac{R_3}{R_4} L_2$$

At balance,

$$R_1 = \frac{R_3}{R_4}(R_2 + r_2)$$

The value of the R3 and the R4 resistance varies from 10 to 1000 ohms with the help of the resistance box. Sometimes for balancing the bridge, the additional resistance is also inserted into the circuit.

on.

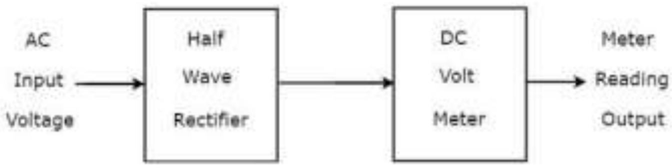
Q.4		**Attempt any THREE of the following :**	**12-Total Marks**
	a)	**Explain with sketches the working of rectifier type of AC voltmeter.**	**4M**
	Ans:		**4M**

Following are the two types of rectifier based AC voltmeters.

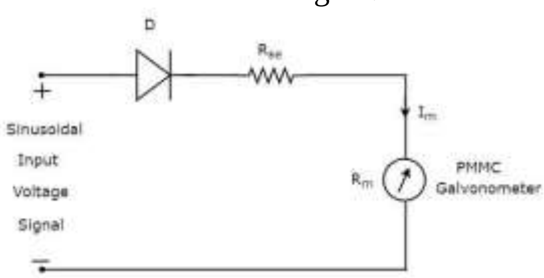
- AC voltmeter using Half Wave Rectifier
- AC voltmeter using Full Wave Rectifier

AC voltmeter using Half Wave Rectifier:

If a Half wave rectifier is connected ahead of DC voltmeter, then that entire combination together is called AC voltmeter using Half wave rectifier. The block diagram of AC voltmeter using Half wave rectifier is shown in below figure.



The above block diagram consists of two blocks: half wave rectifier and DC voltmeter. We will get the corresponding circuit diagram, just by replacing each block with the respective component(s) in above block diagram. So, the circuit diagram of AC voltmeter using Half wave rectifier will look like as shown in below figure.



The rms value of sinusoidal (AC) input voltage signal is

$$V_{rms} = V_m/\sqrt{2}$$
$$= V_m = \sqrt{2} V_{rms}$$
$$= V_m = 1.414 V_{rms}$$

Where,
Vrms is the maximum value of sinusoidal (AC) input voltage signal.

The DC or average value of the Half wave rectifier's output signal is

$$V_{dc}=V_m/\pi$$

Substitute, the value of Vm in above equation.

$$V_{dc}=1.414V_{rms}/\pi$$

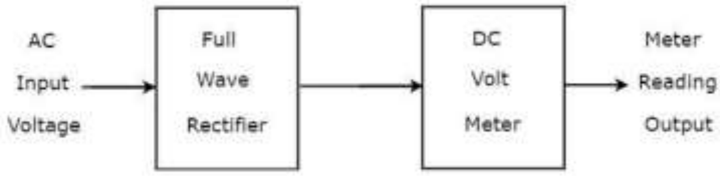
$$V_{dc}=0.45V_{rms}$$

Therefore, the AC voltmeter produces an output voltage, which is equal to 0.45 times the rms value of the sinusoidal (AC) input voltage signal.

OR

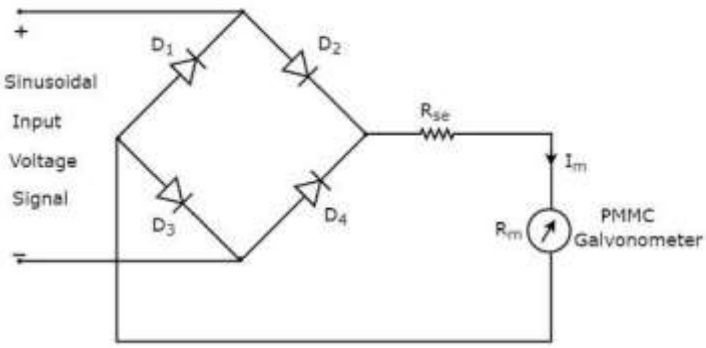
AC voltmeter using Full Wave Rectifier:

f a Full wave rectifier is connected ahead of DC voltmeter, then that entire combination together is called AC voltmeter using Full wave rectifier. The **block diagram** of AC voltmeter using Full wave rectifier is shown in below figure



The above block diagram consists of two blocks: full wave rectifier and DC voltmeter. We will get the corresponding circuit diagram just by replacing each block with the respective component(s) in above block diagram.

So, the **circuit diagram** of AC voltmeter using Full wave rectifier will look like as shown in below figure.



The **rms value** of sinusoidal (AC) input voltage signal is

$$V_{rms}=V_m/\sqrt{2}$$

$$=V_m=\sqrt{2}V_{rms}$$

$$=V_m=1.414V_{rms}$$

Where,
Vm is the maximum value of sinusoidal (AC) input voltage signal.

The **DC** or average value of the Full wave rectifier's output signal is

$$V_{dc}=2V_m/\pi$$

Substitute, the value of Vm in above equation.

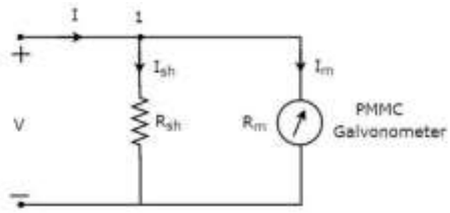
$$V_{dc}=2x\ 1.414V_{rms}/\pi$$

$$V_{dc}=0.9V_{rms}$$

Therefore, the AC voltmeter produces an output voltage, which is equal to **0.9** times the rms value of the sinusoidal (AC) input voltage signal.

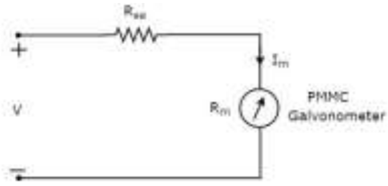
b)	**Sketch labeled equivalent circuit diagram ammeter and voltmeter.**	**4M**

Ans: **DC Ammeter** — **2M each**



I = total current flowing in the circuit in Amp.
Ish is the current through the shunt resistor in Amp.
Rm is the ammeter resistance in Ohm.

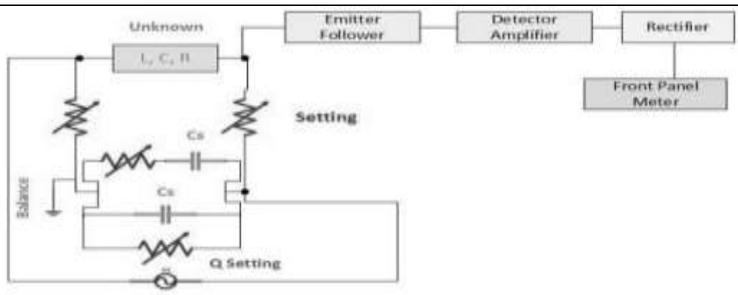
DC Voltmeter



Rse is series multipliers
Im is the full scale deflection of the movement
Rm is the internal resistance of the movement

c) **Describe with sketches the working of LCR meter.** — **4M**

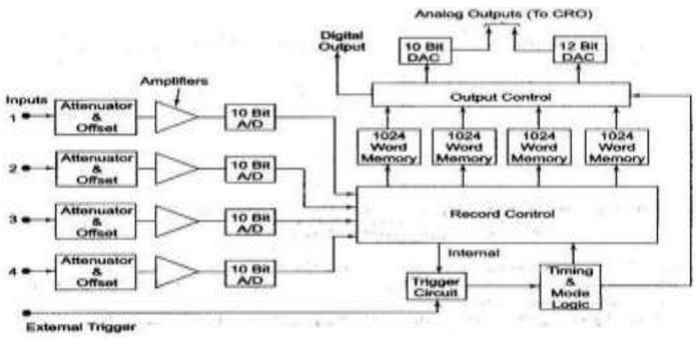
Ans: — **2M diagram,**



Explanation: — **2M**

The above block diagram clearly defines the connection diagram of the LCR meter. The measurement of DC quantities will be done by exciting the bridge with DC voltage. On the contrary, the AC measurements require excitation of the Wheatstone bridge with AC signal. For providing AC excitation, the oscillator is used in the circuit. It generates the frequency of 1 kHz. The bridge is adjusted in null position in order to balance it completely. Besides, the sensitivity of the meter should also be adjusted along with balancing of the bridge. The output from the bridge is fed to emitter follower circuit. The output from emitter follower circuit is given as an input to detector amplifier. The significance of detector amplifier can be understood by the fact that if the measuring signal is low in magnitude, it will not be able to move the indicator of PMMC meter. Thus, in order to achieve the sustainable indication we need to have a high magnitude measuring signal.
But it is often observed that while dealing with the measurement process, the magnitude of the measuring signal falls down due to attenuation factor. The problem to this solution is to utilize an amplifier. The rectifier is used in the circuit to convert the AC signal into DC signal. When the bridge is provided with AC excitation then at the output end of the bridge the AC signal needs transformation into DC signal.

d) **State the role of oscillator and attenuator in the block diagram of signal generator.** — **4M**

	Ans:	**Oscillator** in signal generator produces a periodic, oscillating electronic signal, often a sine wave or a square wave. They convert direct current (DC) from a power supply to an alternating current (AC) signal. **Attenuators:** Attenuators are used in signal generators to regulate the voltage of the output signal. Only accurately calibrated attenuators can be used because the signal strength of the generators must be regulated to avoid overloading the circuit receiving the signal.	**2M** **2M**
	e)	**Describe with sketches the working of Digital storage Oscilloscope.**	**4M**
	Ans:	**Diagram:**  **Explanation:** The input is amplified and attenuated with input amplifiers. The output of the input signal amplifiers feeds an analog to digital converter (ADC). There are numbers of ADC available. But the selection of ADC is depends on the speed of converters, because the conversation of analog to digital signal should be in fast rate. A digital storage oscilloscope digitizes the input signal, so that all subsequent signals are digital. The storage occurs in electronic digital memory. 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.	**2M** **2M**
Q.5		**Attempt any <u>TWO</u> of the following:**	**12Total Marks**
	a)	**State the importance of calibration. Describe the procedure for calibration of Digital instrument.**	**6M**
	Ans:	**Importance of Calibration:** • Calibration is vitally important wherever measurements are important, it enables users and businesses to have confidence in the results that they monitor, record and subsequently control. • It is the process to compare measurement with standard instrument set the instrument or meter to that standard • Calibration defines the accuracy and quality of measurements recorded using a piece of equipment. **Calibration process of Digital Instrument:** 1. For calibration of any measuring instrument digital or analog require at least two meters, one will be standard meter which will be recommended by ISO or IEEE	**2M** **3M**

		standard and other meter is the one under calibration. Other requirement is any standard and reliable physical quantity source. 2. Analog and digital calibration process is slightly different. 3. In case of analog instrument pointer sensitivity, minimum and maximum deflection and least count of scale is important. 4. For Digital measurement resolution and maximum and minimum number reading is important. 5. Output of physical quantity with signal conditioning (so that the output is electrical) should be connected to the standard meter. Measure minimum and maximum value of the given input signal and tabulate with multiple iteration. 6. Now Output of physical quantity with the same signal conditioning should be connected to meter under calibration. With same iterations as in step 6 ,minimum and maximum values should be measured and tabulated by this meter. 7. Compare with the standard meter reading with test meter reading. 8. If found any error with measurement range of meter then adjust the meter using calibration knob or set for minima and maxima values and test again.  **<u>Any other relevant diagram can be drawn</u>** **<u>[Note : For any digital instrument calibration procedure mark should be given]</u>**	**1M (Diagram)**
	b)	**Describe with sketches the working of analyser. List two specifications and applications of logic analyser.**	**6M**
	Ans:	A **logic analyzer** is an electronic instrument that captures and displays multiple signals from a digital system or digital circuit. A logic analyzer may convert the captured data into timing diagrams, protocol decodes, state machine traces, assembly language, or may correlate assembly with source-level software. Logic analyzers have advanced triggering capabilities, and are useful when a user needs to see the timing relationships between many signals in a digital system Once the probes are connected, the logic analyzer is programmed with the names of each signal. The analyzer can also associate several signals into groups so that they can be manipulated more easily. **Setting logic analyser capture mode** With the basic set-up of the logic analyser complete the capture mode for the data needs to be chosen. This can be set to one of two modes: • **Timing mode** Using this mode signals are sampled at regular intervals based on an internal or external clock. • **State mode** Here one or more of the signals are defined as clocks, and data is sampled on the edges of these clocks. **Setting the logic analyser trigger mode** Once the logic analyser mode is chosen then the trigger condition can be set. There are two	**2M (Explanation)**

basic types of trigger mode available:

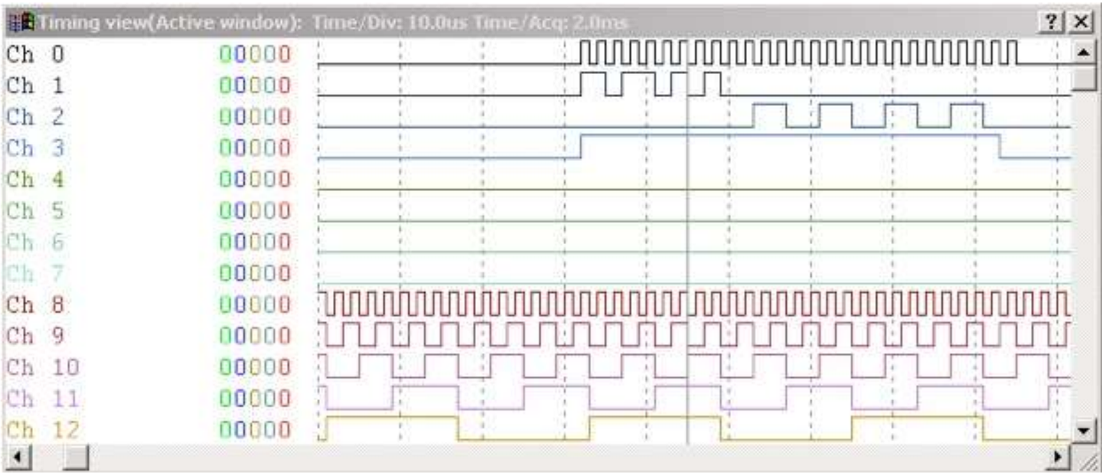
- ***Pattern trigger:*** Setting trace specifications on a timing analyser very different to setting trigger level and slope on an oscilloscope. Many logic analysers trigger on a pattern of highs and lows across input lines. This equates to a certain data pattern on number appearing across a data bus for example. This can normally be set in binary (1's and 0's) hex, octal, ASCII, or decimal numbering. Using a hex format for defining the trigger point is particularly helpful when looking at buses that are 4, 8, 16, 24, or 32 bits wide.
- **Edge trigger*:*** When the trigger level control on an oscilloscope is adjusted, this can be considered in the same way as setting the level of a voltage comparator that triggers when the input voltage crosses its threshold level. A timing analyser works essentially the same on edge triggering except the trigger level is pre-set to logic threshold. While many logic devices are level-dependent, clock and control signals of these devices are often edge-sensitive. Edge triggering enables the data capture to starts when the device is clocked.

Application:{any two 1mark} **1M**

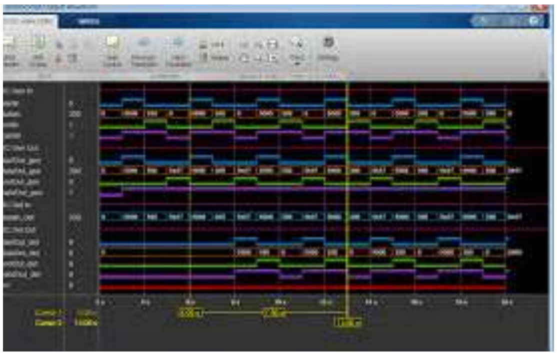
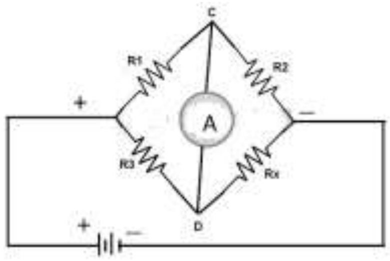
1. To view multiple digital waveform
2. Troubleshooting and analysis of digital data from different digital equipment
3. A logic analyzer overcomes the limits of an oscilloscope by providing many channels of data, as well as long data display times.
4. Multiple data channel can be analyze
5. To group channels into logical groups

Specification (any two 1mark) **1M**

1. Number of channel (50 t0 150 channel)
2. Operating frequency
3. Operating Speed (maximum to measure channel)
4. Timing resolution
5. Memory capacity
6. Screen size



2M(Sketches)

		 **OR**  **[any other relevant sketches can be considered]**	
	(c)	**Determine the smallest measurable change in the voltage of an analog voltmeter having range 0–200 v with resolution of 0.15% of full scale.**	**6M**
	Ans:	Smallest measurable change is least count or resolution **=**maximum measure **X** percentage Resolution/100 =200 X(.15/100) =0.30 V **0.3 Volt minimum Voltage can be measured using this voltmeter**	**3M** **(Formula)** **3M** **(Answer)**
Q.6		**Attempt any TWO of the following:**	**12Total Marks**
	(a)	**Describe with sketches the procedure to measure resistance using wheatstone bridge.**	**6M**
	Ans:	**Description:** The most common and simplest bridge network to find the resistance is the DC Wheatstone Bridge. This bridge is used where small changes in resistance are to be measured like in sensor applications. This is used to convert a resistance change to a voltage change of a transducer. The combination of this bridge with operational amplifier is used extensively in industries for various transducers and sensors. A Wheatstone bridge consists of four resistors that are connected in the shape of a diamond with the supply source and indicating instruments shown in figure. **Diagram:**  This bridge is used to find the unknown resistance very precisely by comparing it with a	**2M** **2M**

known value of resistances. In this bridge null or balanced condition is used to find the resistance**.** For this bridge balanced condition voltage at points C and D must be equal. Hence, no current flows through the galvanometer. For getting the balanced condition one of the resistors must be variable. From the figure,

The voltage at point D = $V \times R_X / (R_3 + R_X)$

The voltage at point C = $V \times R_2 / (R_1 + R_2)$

The voltage (V) across galvanometer or between C and D is,

$VCD = V \times R_X / (R_3 + R_X) - V R_2 / (R_1 + R_2)$

When the bridge is balanced VCD = 0, **2M Formula**

So,

$V \times R_X / (R_3 + R_X) = V R_2 / (R_1 + R_2)$

$R_X R_1 + R_X R_2 = R_2 R_3 + R_2 R_X$

$R_1 R_X = R_2 R_3$

$R_2/R_1 = R_X/R_3$

This is the condition to balance the bridge. And for finding the unknown value of resistance

$R_X = R_3 \times (R_2 / R_1)$

From the above equation R4 or Rx can be computed from the known value of resistance R_3 and the ratio of R_2/R_1. Therefore, most of the cases R_2 and R_1 values are fixed and the R_3 value is variable so that null value is achieved and the bridge gets balanced.

(b) **Explain how frequency and amplitude is measured on CRO with one example.** **6M**

Ans: Measurement amplitude and frequency on oscilloscope connect the input signal into the oscilloscope's input port. **2M**

- Signals can be connected through a dedicated probe.
- Set the trigger point properly
- When there is no input single line should be displayed by the CRO
- Switch on the source of input. For example a function generator with sin wave output and connect to CRO
- Set time/div and vol/div knob in such a way that will give stable output as shown in the figure.

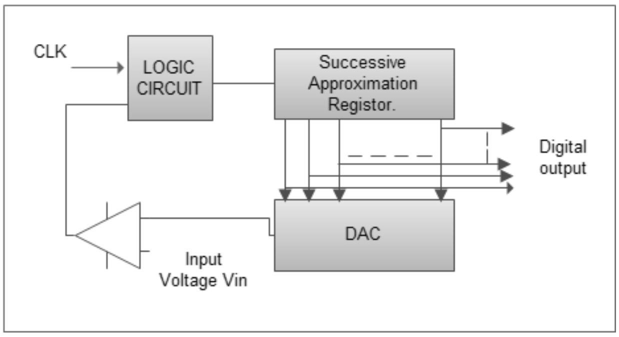
Amplitude Measurement

- Suppose vol/div knob is on 2V and time/div knob is on 5ms then we count vertical divisions from center for amplitude measurement up to its maximum value displayed.
- For given figure we have to adjust exactly at center
- Total division in the given fig is 2.6
- Therefore, Amplitude is 2.6 X2V=5.2 Volt

Frequency Measuremment **2M**

- For time/frequency measurement, we measure the divisions horizontally from starting of cycle to end of complete cycle i.e. one positive half cycle and one negative half cycle.
- In this example, there are 4 divisions for one cycle.
- Therefore, Time = 4 X5 ms = 20ms
- For frequency, we have to take reciprocal of time, that is,1 /20ms = 50Hz

2M

		[Any other relevant diagram should be considered]	
	c)	**Explain with sketches the working of successive approximation voltmeter. State its two specifications and two applications.**	**6M**
	Ans.	**Diagram**  **Explanation:** The successive approximation type DVM is special type of potentiometric DVM in which a digital divider is used in the place of linear divider. The servomotor replaced by electromagnetic logic. The comparator compares the output of digital to analog converter with unknown voltage. The digital to analog converter successively generates the sequence of digits. The signal is sent to the output for display ,when the output of digital to analog converter becomes equal to the unknown voltage. It is a special analog to digital conversion technique which is also known as binary regression. The block diagram of successive approximation type DVM is shown in above figure. The comparator is used to compare the output of digital to analog converter with unknown input voltage. The comparator output is given to the sequencer and logic controller. The sequence of code is generated by the sequencer which is applied to digital to analog converter. The output of DAC is available at position 1 and the unknown voltage which is to be measured is available at position 2. The logic control is used to drive the clock. The clock signal is used to connect the switch at position 1 or 2. **Specification:** • Meter resolution • Maximum range • Accuracy • Senstivity • Size of display • Speed of conversion • Operating frequency **Application** • Digital multimeter • Instrumentation system • Physical quantity measurement like weinghing machine • fast operating digital display for measurement	**2M** **2M** **1M(Any two)** **1M(Any two)**