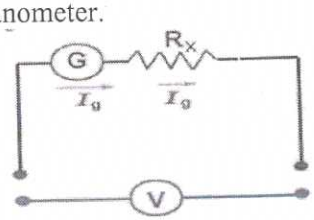
222

April – 24
Page no - 8

Scoring Indicators

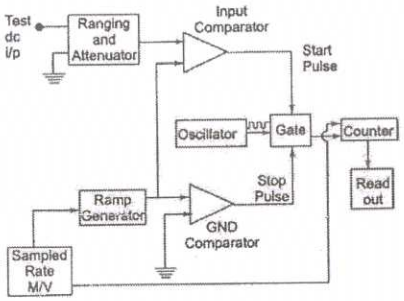
COURSE NAME : **ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**

COURSE CODE : **4042** **QID: 2103230117**

Q No	Scoring Indicators	Split score	Sub Total	Total Score
	PART A			**9**
I. 1	Accuracy	1	1	9
I. 2	Permanent magnet moving coil	1	1	
1.3	Eddy current	1	1	
I. 4	Phosphorus	1	1	
I. 5	lissajous pattern	1	1	
I. 6	Wheatstone bridge, Kelvin Double bridge	½ +½	1	
I. 7	Sine wave, square wave, triangular wave, saw tooth wave, pulse trains	Anyo ne	1	
I. 8	A transducer is an electronic device that converts energy from one form to another	1	1	
I. 9	Passive Transducer	1	1	
	PART B			30
II. 1	Precision: A measure of the consistency or repeatability of measurements, i.e. successive readings does not differ. Resolution: The smallest change in a measured variable to which an instrument will respond.	1 ½ 1 ½	3	3
II. 2	Voltmeter is an instrument used to measure the potential difference between two points of the electrical circuit. A galvanometer can be converted in to voltmeter by connecting a very high resistance in series with the galvanometer. 	1 ½ 1 ½	3	3

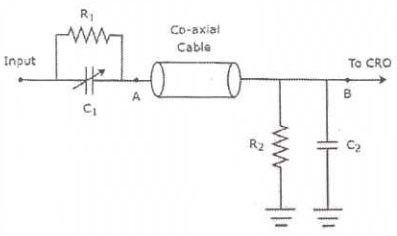
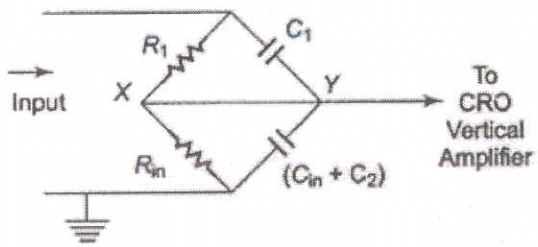
II. 3		Any three	3	3

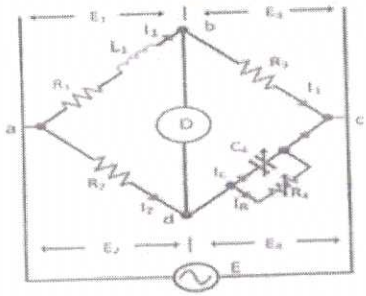
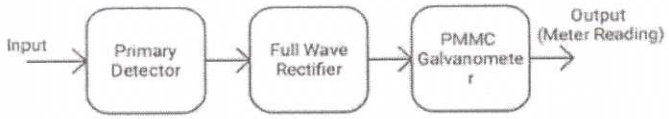
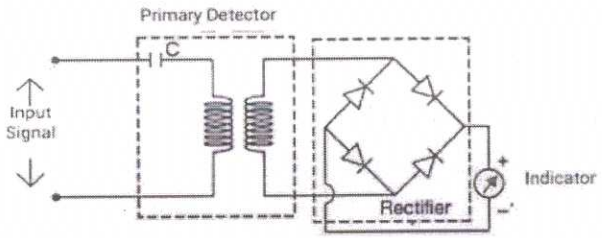
Moving coil	Moving iron
Coil moves	Iron piece moves
DC measurements	Ac & DC measurements
Low power consumption	High power consumption
More accuracy	Less accuracy
Deflection proportional to square of current	Deflection proportional to current
Eddy Current Damping	Air Friction Damping
Working Principle - Similar to DC Motor	Working Principle - Magnetism

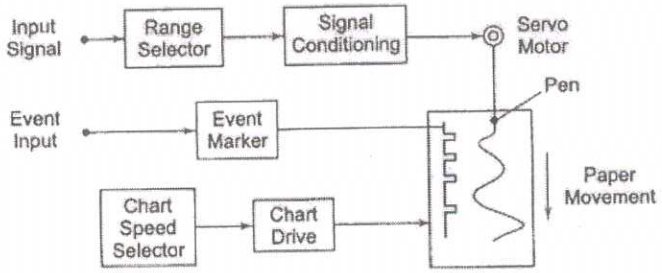
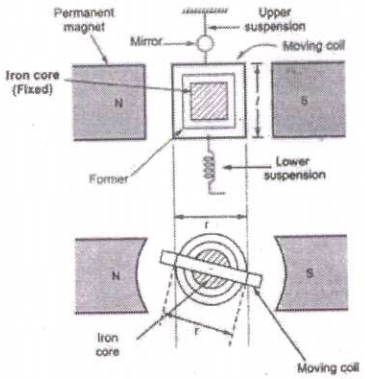
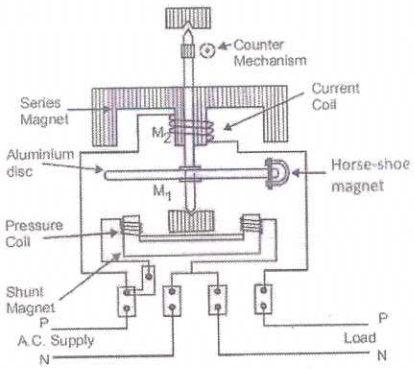
II. 4		3	3	3

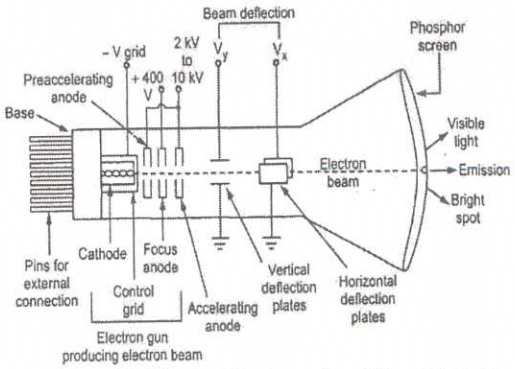
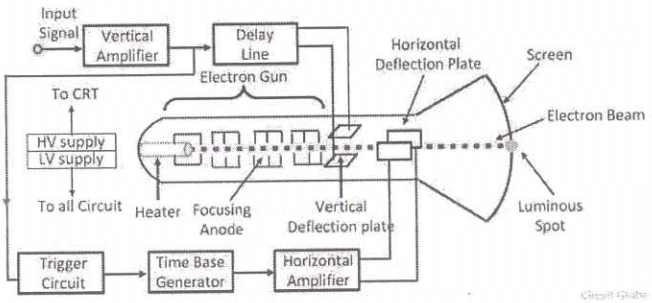
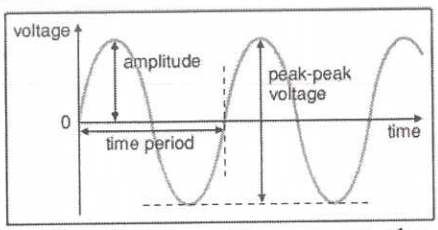
II. 5		Any 3	3	3

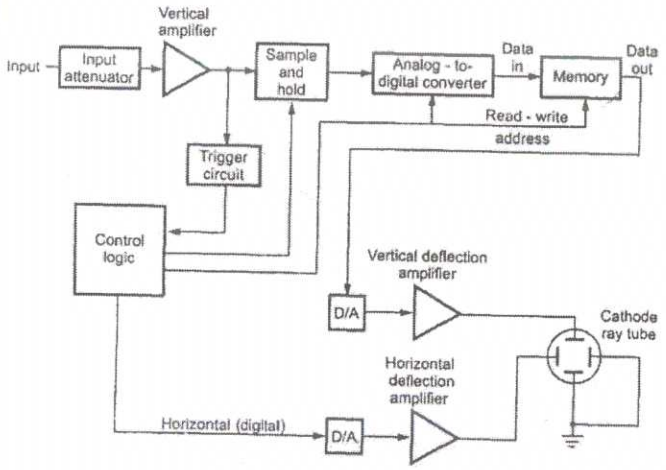
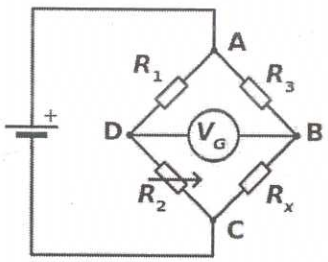
Dual Trace CRO	Dual beam CRO
It is used electron beam to display two traces	It is used two electron beams for displaying two signals
A single vertical amplifier is used	Two vertical amplifiers are used for two beams
It is not able to capture two fast transient events	It captures two fast transient easily
It cannot switch quickly between traces, so simultaneous display becomes difficult.	It can display two traces simultaneously.
The two signals may or may not have same frequency	The two signals must have the same frequency
A single beam can be used for displaying multiple traces	multiple beams are used for displaying multiple traces
Two signals can be displayed on a dual trace oscilloscope. But the two signals cannot be displayed together in real time.	Two signals can be displayed simultaneously in real time.

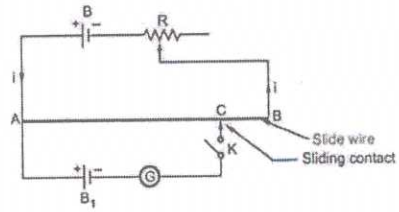
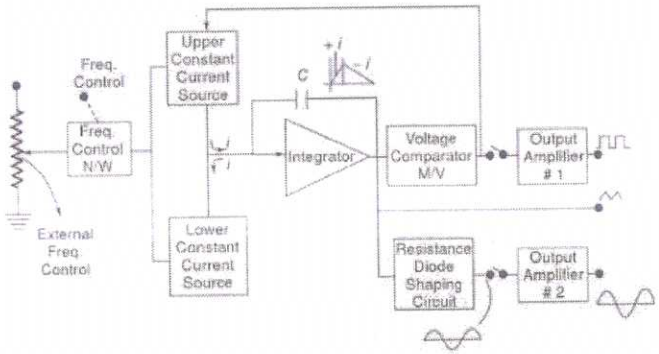
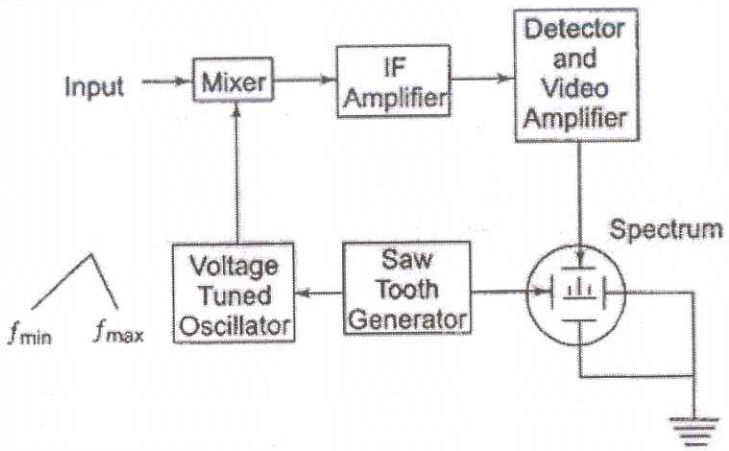
II. 6		1 ½		3
		1 ½	3	

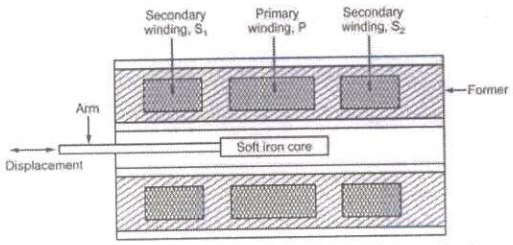
II.7	The bridge used for measurement of self inductance of the circuit is known as the Maxwell bridge. It is the advanced form of the Wheatstone bridge. The Maxwell bridge works on the principle of the comparison, i.e., the value of unknown inductance is determined by comparing it with the known value or standard value.  $R_1 = \frac{R_2 R_3}{R_4}$ $L_1 = R_2 R_3 C_4$	Expln 1 Fig. 1 Equn 1	3	3
II. 8	A wave analyzer is an instrument designed to measure relative amplitudes of single frequency components in a complex waveform. Basically, a wave instrument acts as a frequency selective voltmeter which is tuned to the frequency of one signal while rejecting all other signal components. It consists of three blocks – the primary detector, full wave rectifier, and PMMC galvanometer.  	3	3	3
II. 9	Primary transducer Secondary transducer Analog transducer Digital transducer Electrical transducer Mechanical transducer Active transducer Passive transducer	3	3	3
II.10	Strip chart recorders consist of a roll or strip of paper that passes linearly beneath one or more pens. As the signal changes, each pen's deflection records the process being measured in the form of a chart.	1 ½		

		1 ½	3	3
	PART C			
III	 It works on the principle of energy conversion from mechanical to electrical. Once the power supply is turned ON, the flow of current within the magnetic field can be realized. If it is open to revolve in the controlling torque, then it is turned through an angle that is proportional to the flow of current through it. This instrument is an ampere meter type, mainly used to gauge as well as to detect electric current. It consists of moving coil, iron core, suspension, damping, indication and zero adjustment.	Fig 4 Expl n 3	7	7
IV	 The energy meter has the aluminium disc whose rotation determines the power consumption of the load. The disc is placed between the air gap of the series and shunt electromagnet. The shunt magnet has the pressure coil, and the series magnet has the current coil. The pressure coil creates the magnetic field because of the supply voltage, and the current coil produces it because of the current. The force on the disc is proportional to the current and voltage of the coil.	Fig 4 Expl n 3	7	7

V	 The cathode ray tube (CRT) is the heart of the C.R.O. The CRT generates the electron beam, accelerates the beam, deflects the beam and also has a screen where beam becomes visible as a spot. The main parts of the CRT are Electron gun, Deflection system, Fluorescent screen, Glass tube or envelope, Base.	Fig 4 Expl n 3	7	7
VI	 The main parts of the cathode ray oscilloscope are Cathode Ray Tube, Electronic Gun Assembly, Deflecting Plate, Fluorescent Screen For CRT, Glass Envelop.When the electron is injected through the electron gun, it passes through the control grid. The control grid controls the intensity of electron in the vacuum tube. If the control grid has high negative potential, then it allows only a few electrons to pass through it. Thus, the dim spot is produced on the lightning screen. If the negative potential on the control grid is low, then the bright spot is produced. Hence the intensity of light depends on the negative potential of the control grid.	Fig 4 Expl n 3	7	7
VII	 Measurement of A.C voltage : - To measure the ac voltage of sinusoidal waveform, The A.C. signal, from the signal generator, is applied across the y – plates. The voltage (deflection) sensitivity band switch (Y-plates) and time base band switch (X-plates) are adjusted such that a steady picture of the waveform is obtained on the screen. The vertical height i.e. peak-to-peak height is measured. When this peak-to-peak height is multiplied by the voltage (deflection) sensitivity (n) i.e. volt/div, we get the peak-to-peak voltage (2Vo). From this we get the peak voltage (Vo). The rms voltage Vrms is equal to Vo/ 2 .	Fig 1 Expl n 3	7	7

	Measurement of frequency: - An unknown frequency source (signal generator) is connected to y- plates of C.R.O. Time base signal is connected to x – plates (internally connected) . We get a sinusoidal wave on the screen, after the adjustment of voltage sensitivity band switch (Y-plates) and time base band switch (X-plates). The horizontal length between two successive peaks is noted. When this horizontal length is multiplied by the time base(m) i.e. sec/div , we get the time-period (T).The reciprocal of the time-period(1/T) gives the frequency(f).	Expn 3	7	7
VIII	 The input signal is applied to the amplifier and attenuator section. The attenuated signal is then applied to the vertical amplifier. The output of the vertical amplifier is applied to the A/D converter section. The sampling rate and memory size are selected depending upon the duration & the waveform to be recorded. Once the input signal is sampled, the A/D converter digitizes it. The signal is then captured in the memory. Once it is stored in the memory, many manipulations are possible as memory can be readout without being erased.	Fig 4 Expln 3	7	7
IX	 The basic concept of the bridge is that in a balanced condition,when, R1/ R3 = R2/ Rx, the deflection in the voltmeter Vg is zero, i. e. no current flows through arm BD. The resistors R1 and R3 are fixed. Rx is the unknown resistance and R2 is a variable resistor. We vary R2 such that the voltmeter Vg shows no deflection. In that case, we assume that the bridge is balanced. Hence, at that particular value of R2, Rx = R2 * (R3/R1), which will give us the value of Rx.	Fig 4 Expln 3	7	7

X	 Slide wire is made up of manganin. Let **r *be* the resistance per unit Length** of slide wire. The battery supplies a current through the slide wire which is limited with the help of rheostat. The battery B1 Whose e.m.f. is to be measured is connected in series with a galvanometer G and switch K. When the switch K is opened, the current through slide wire is i. If the sliding contact is at position C, let the length AC be l Units, then the voltage drop across AC is given by ir1. Consider that switch K is closed which puts the battery B_1 in the circuit. The battery B_1 whose e.m.f. is to be measured is connected such that the voltage drop along the slide wire and e.m.f. of B_1 oppose each other. The deflection in the galvanometer G depends on of magnitude of voltage drop across the slide wire portion AC and e.m.f. of B1. E = i(r.l)	Fig 3 Expln 3 Eqn 1	7	7
XI	 Explanation of each block	Fig 4 Expln 3	7	7
XII	 Explanation of each block	Fig 4 Expl 3	7	7

XIII	**Operating range** : The range of transducer should be appropriate for measurement to get a good resolution. **Operating Principle** : The transducers are selected on the basis of operating principle it may be resistive, inductive, capacitive, optical etc. **Accuracy** : The accuracy should be as high as possible or as per the measurement. **Range** : The transducer can give good result within its specified range, so select transducer as per the operating range. **Sensitivity** : The transducer should be more sensitive to produce the output or sensitivity should be as per requirement. **Environmental compatibility** : The transducer should maintain input and output characteristic for the selected environmental condition. **Loading effect**: The transducer's input impedance should be high and output impedance should be low to avoid loading effect. **Errors** : The error produced by the transducer should be low as possible.	Any 7	7	7
XIV	 LVDT is based on the principle of Faraday's law of electromagnetic induction. Primary winding of the LVDT is connected to the AC power supply, the alternating magnetic field is produced in the primary winding, which results in the induced emf the secondary windings.	Fig 4 Expln 3	7	7