Experiment: 1

INTRODUCTION TO MEASURING INSTRUMENTS

Part-A

Aim:

a) To measure the thickness of a meter scale using Screw gauge

b) To measure the breadth of a meter scale using Vernier caliper

c) To find least count and readings using Travelling microscope

Apparatus: Screw gauge, Vernier caliper, Travelling microscope and meter scale

Screw Gauge

Theory

The screw gauge is an instrument used for measuring the diameter of a thin wire or the thickness of a sheet of metal. The head of the screw has a ratchet which avoids undue tightening of the screw. On the thimble there is a circular scale known as head scale which is divided into 50 or 100 equal parts. When the screw is worked, the sleeve moves over the pitch scale.

Pitch of the Screw Gauge

The pitch of the screw is the distance moved by the spindle per revolution.

The pitch is given by;

$$\text{Pitch of the screw} = \frac{\text{Distance moved by screw}}{\text{No. of full rotations given}}$$

Least Count (LC)

The LC of any instrument is the minimum value that it can measure (eg: the LC of a standard wrist watch is 1sec).

The LC is the distance moved by the tip of the screw, when the screw is turned through 1 division of the head scale.

The LC of screw gauze is given by:

$$\text{Least count} = \frac{\text{Pitch}}{\text{Total number of divisions on the circular scale}}$$

Tabulation: To measure the thickness of a meter scale using Screw gauze

Least count = …….mm

Zero error = …..div Zero correction = …..div

PSR (mm)	HSD(div)	CHSD(div)	TR = PSR + (CHSD X LC) (mm)

Average thickness =

b) Vernier Caliper

Theory

A caliper is a device used to measure the distance between two opposing sides of an object. The Vernier Caliper is a precision instrument that can be used to measure internal and external distances accurately. The main scale consists of a steel metallic strip graduated in centimeters at one edge and in inches at the other edge. It carries the inner and outer measuring jaws.

Least Count

$$\text{Least Count} = \frac{\text{One Main scale(MS) division}}{\text{Number of divisions in Vernier Scale}}$$

Total Reading:

$$TR = MSR + VSR = N + (n \times L.C)$$

Tabulation: To measure the breadth of a meter scale using vernier calliper

Least count = …….cm

MSR (cm)	CVD (div)	TR = MSR + (CVD X LC) (cm)

Average breadth =

c)Travelling Microscope

Theory

Travelling Microscope consists of an ordinary compound microscope which slides along a graduated vertical pillar, attached to horizontal base resting on the leveling screws. The main scales divisions along with vernier scale divisions are marked on the horizontal base and the vertical pillar. The microscope can be moved up and down in the vertical pillar and can be moved in to and fro direction over the horizontal base. Thus the microscope can be moved both in the vertical and horizontal directions. Two fine adjustment screws are provided for the horizontal and vertical movements respectively. The image of the object can be focused by adjusting the side screw (S) attached to the microscope. The eye piece of the microscope is provided with a cross wire.

Least count of Travelling Microscope: Least count = 1 MSD/Total number of VSD

= 0.05cm/ 50 = 0.001cm

Tabulation: To take readings using travelling microscope

Sl. No.	MSR (cm)	CVD(div)	Total reading =MSR+ (CVDxLC) (cm)
			R_1 =
			R_2 =

Part-B

Aim: a) To measure voltage and frequency with a cathode ray oscilloscope (CRO) and digital storage oscilloscope (DSO)

b) Basic understanding of use of bread boards

Apparatus: CRO, DSO, breadboard, Signal generator

Measurement of Voltage:

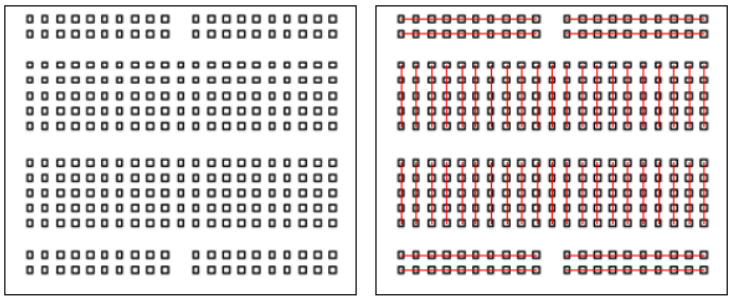
No. of divisions from positive peak to negative peak along y-axis (N)	Scale along y-axis (S) (Volts)	Voltage (NxS) (Volts)

Measurement of Frequency:

No. of divisions between consecutive crest or trough along x-axis (N)	Scale along x-axis (S) [Sec(s)]	Time period (T=NxS) [sec(s)]	Frequency (f=1/T) (Hz)

A breadboard is a construction base for prototyping of electronics. Because the solderless breadboard does not require soldering, it is reusable. This makes it easy to use for creating temporary prototypes and experimenting with circuit design.

Figures shows the layout of a segment of a typical breadboard (fig a) and the wiring diagram of its backplane (fig b).



(a) (b)

In both figures, the top two horizontal rows and the bottom two horizontal rows of the breadboard are typically used for power busses and ground busses. A bus is simply a node with multiple connection points all of which are at the same electrical potential or voltage. The rows on the breadboards are typically labeled with letters (A, B, C,) " while the columns are numbered (1, 5, 10,) " thus allowing specific identification of each node. Some boards may be marked differently or may be unmarked.