PROGRAM SEPENUH MASA *UTMSPACE*
UNIVERSITI TEKNOLOGI MALAYSIA INTERNATIONAL CAMPUS
EXPERIMENT 3

Title :Oscilloscope and Function Generator

Objectives: Understanding the procedures of using oscilloscopes
Measurement precision testing
Measuring alternating current voltage obtained from the function generator
Measuring frequencies and basic timing

Equipment : Oscilloscope
Function generator
Probes
Wires
Digital Multimeter
Proto Board

Precaution:

Make sure that:

a) The main switch is ON before switching on the oscilloscope
b) Switch OFF the oscilloscope first, then the main switch
c) Leave the oscilloscope ON during the whole lab session
d) Ground the grounding wire. The probe has two connecting wires that one of it must be grounded.

Instructions

1.0 Getting the oscilloscope ready [C03, P02]

1.1 Before switching on the power supply of the oscilloscope, ensure that the control panel positions are as below.

	Control Panel	Position
1	POWER	OFF
2	INTEN	Rotate clockwise positioned at 3 o'clock
3	FOCUS	Center position
4	ILLUM	Rotate anticlockwise until maximum
5	VERT MODE	CH1
6	POSITION	Middle position –press inwards
7	VOLTS/DIV	0.5/DIV
8	VARIABLE	CAL (clockwise) – pressed inwards
9	AC-GND-DC	GND
10	SOURCE	Set to CH 1
11	COUPLING	AC
12	SLOPE	-
13	LEVEL	LOCK (anticlockwise)
14	HOLDOFF	NORM (anticlockwise)
15	TRIGGER	AUTO
16	TIME/DIV	0.5m SEC/DIV
17	VARIABLE	CAL (pressed inwards)
18	POSITION	Center position. Pressed inwards.

TABLE 1

1.2 Switch on the main power switch and the oscilloscope power switch. A trace line will appear on the oscilloscope screen. If there is no trace line, check the settings again.

1.3 Adjust the trace line intensity using INTEN and FOCUS.

1.4 Adjust the trace line to the middle. If it happens not to be in the middle, do some adjustments using the CH1 POSITION and TRACE ROTATION (using a screw driver)

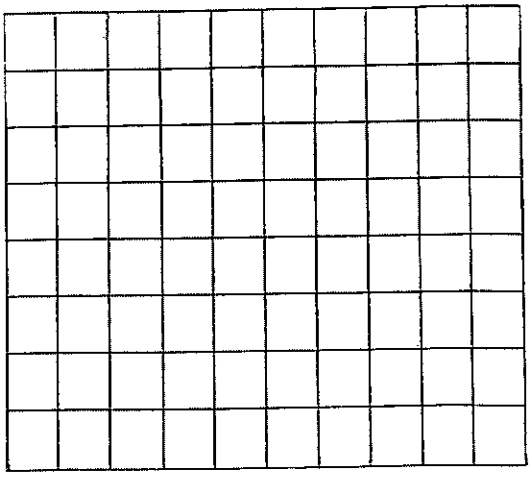
1.5 To set CH2 the steps are the same as setting CH1 and set the VERT MODE to CH2 and repeat steps 1.3-1.4.

1.6 To use both channels, change the VERT MODE to DUAL and two trace lines will appear.

2.0 Setting the Oscilloscope. [Co3, PO2] 12% ✓

2.1 Using probe X1, insert a signal from CAL source to CH1 input source. Set the AC-GND-DC switch to AC. At the CAL print it is stated the type of signal measurement. State the signal measurement: _____

2.2 Place the VVOLT/DIV knob and TIME/DIV knob at a suitable position and get the signal at the oscilloscope screen. Sketch the obtained waveform.



2.3 State the signal value as appeared

Point- to-point voltage, Vp-p = _____Volt.

Time, T = _____secs

Frequency, f = _____Hz

2.4 If the signals appeared are different with the measurement signal, do some corrections by adjusting the VARIABLE control knob.

3.0 Measuring a.c. waveform [Co3, PO2] 24% ✓

Calculation: 1 div = 1 cm	
Vp-p (vertical p-p divisions) x (VOLTS/DIV)	**frequency, f = 1/T**
T = (horizontal divisions/cycle) x (TIME/DIV)	**Vpmkd = Vp-p/(2√2)**

3.1 Follow the wiring in Figure 1

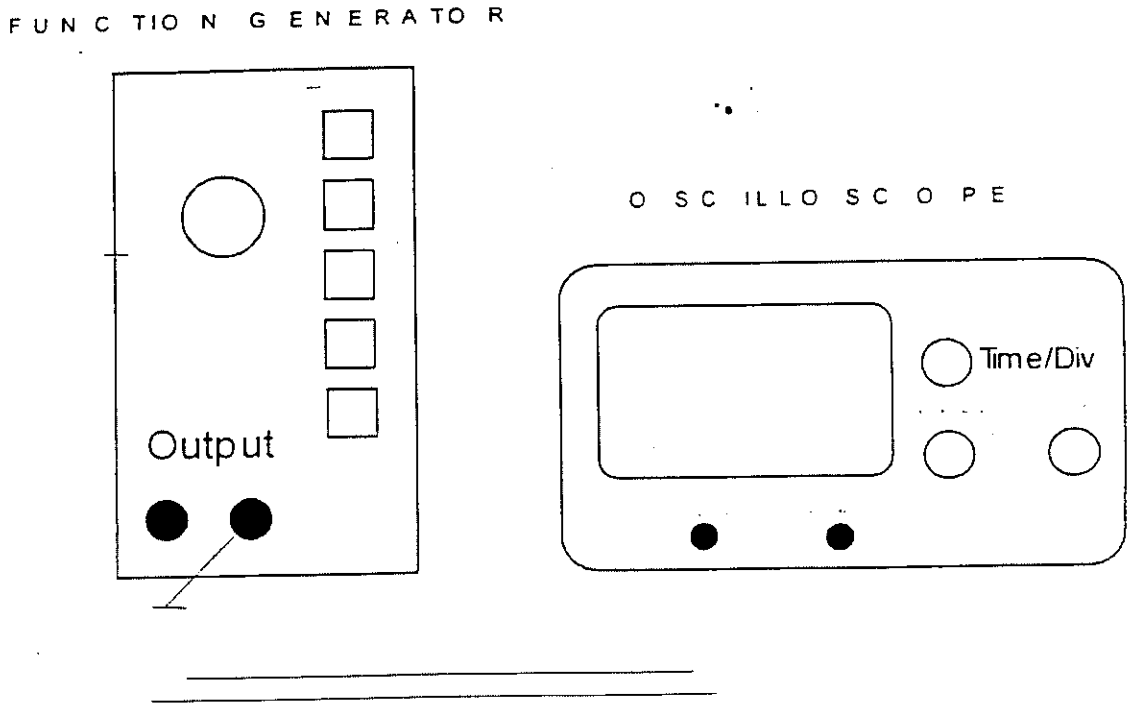


Figure 1

3.2 A function generator is needed to provide signal to the oscilloscope. Set the function generator controller to get a sinusoidal wave with maximum amplitude of 100 Hz.

3.3 Adjust the VOLT/DIV knob and TIME/DIV knob to get a full sinusoidal waveform on the screen.

3.4 State all the data needed in Table 2.

3.5 Measure the voltage of the sinusoidal waveform produced by the function generator using a volt. Meter (A 'pmkd volt' reading will be provided by the volt meter)

3.6 Repeat the above steps for 2/3 and 1/3 amplitude of the previous maximum value. Calculate the error percentage.

$$\text{Error percentage} = \frac{\text{Volt meter reading} - \text{Vpmkd}}{\text{Volt meter reading}} \times 100\%$$

Fill in Table 2

Vertical p-p div (cm) value	VOLT/DIV	Vp-p (volt)	Vpmkd (Volt)	Volt Meter reading	Error percentage

TABLE 2

4.0 Frequency Measurements [C03, P02] 26%

4.1 Display a sinusoidal waveform of any amplitude at 100Hz frequency. Record the time-base scale (TIME/DIV) and the length of one cycle (cm). Use suitable time-base scale to ease measurement.

4.2 Calculate and record the period (T) and the frequency (f) of the waveform.

4.3 Repeat the measurement for frequencies of 1.0 kHz and 4.5 kHz.

4.4 Calculate error percentage for the frequencies. Record all the results in Table 3.

$$\text{Error percentage} = \frac{\text{signal frequency} - \text{calculated frequency}}{\text{Signal frequency}} \times 100\%$$

Signal Frequency	TIME/DIV	Length of one cycle (cm)	Period T (second)	Frequency (Hz)	Error percentage
100 Hz					
1 kHz					
4.5 kHz					

TABLE 3

Conclusion

5.0 Time Base Measurements [Co3, PO2] 44%

5.1 Use the circuit as in Figure 1.

5.2 Input a sinusoidal signal of 1 MHz. Set TIME/DIV at 0.5 µs/div. Measure the length of one cycle in div. (1 div. = 1 cm). Record the result in Table 4. Repeat the measurement for TME/DIV of 1 µs/div.

Signal frequency	TIME/DIV	Length of 1 cycle (div)	Number of cycles Displayed
1 MHz	0.5 µs/div		
	1 µs/div		

TABLE 4

5.3 Set TIME/DIV at 0.5 µs/div. Adjust input signal frequency to display the maximum possible frequency so that the length of one cycle is 2 div.

5.4 Repeat the procedure using 4 div. For one cycle Record all results in Table 5.

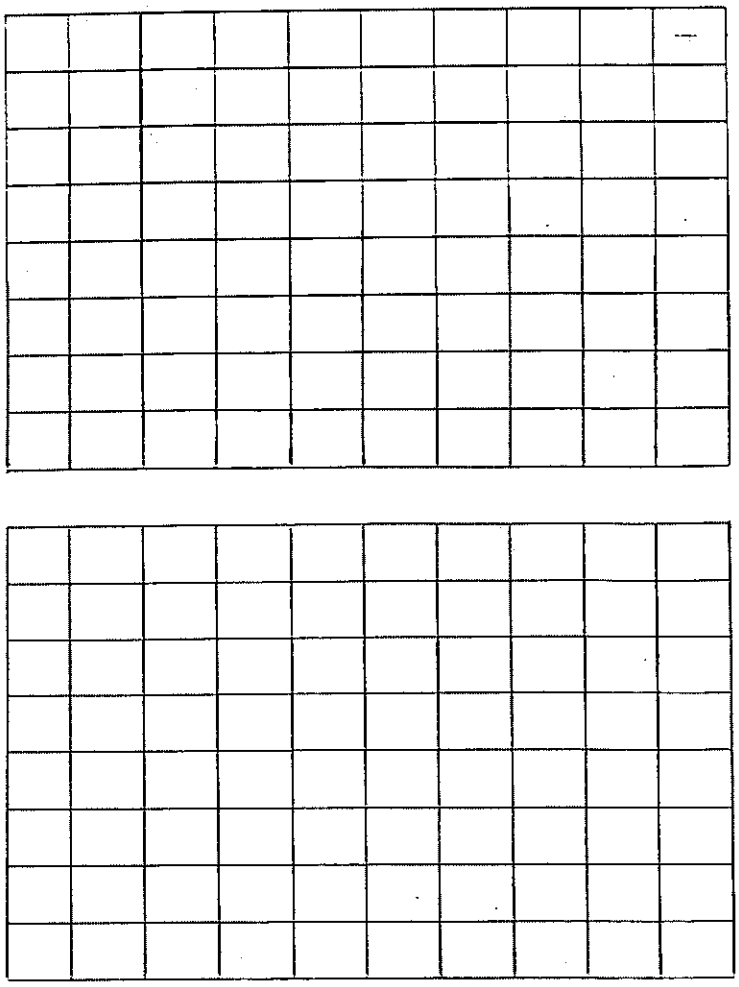
TIME/DIV	Length of one cycle (div)	No. Of cycles displayed	Frequency of oscillator	$F_{calculated}$
0.5 µs/div	2			
	4			
0.2 ms/div	10			
	5			

TABLE 5

5.5 Set TIME/DIV at 0.2 ms/div. Adjust input signal frequency to display a waveform of 10 div./cycle Repeat for 5 div./cycle

5.6 Input a sinusoidal waveform of 500 kHz. Record the TIME/DIV so that one cycle fills 4 div horizontally (4 div). Sketch the waveform displayed.

5.7 Pull out the PULLx10MAG knob for magnification of 10x and draw the waveform displayed.



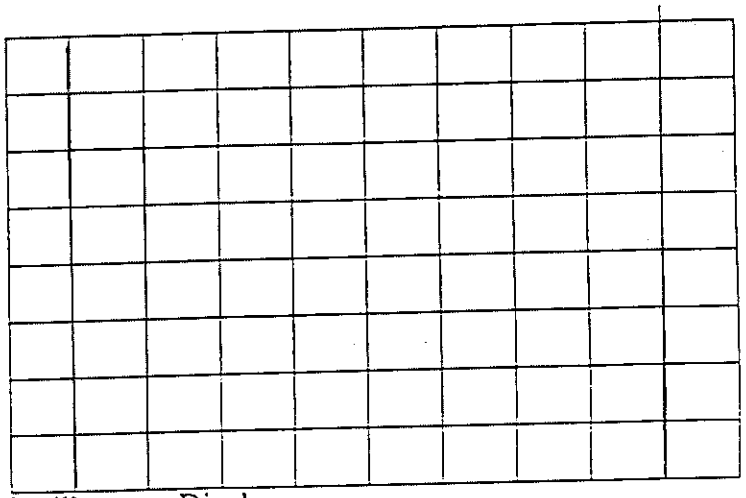
x10MAG Display

Conclusion:

UNDERSTANDING QUESTIONS

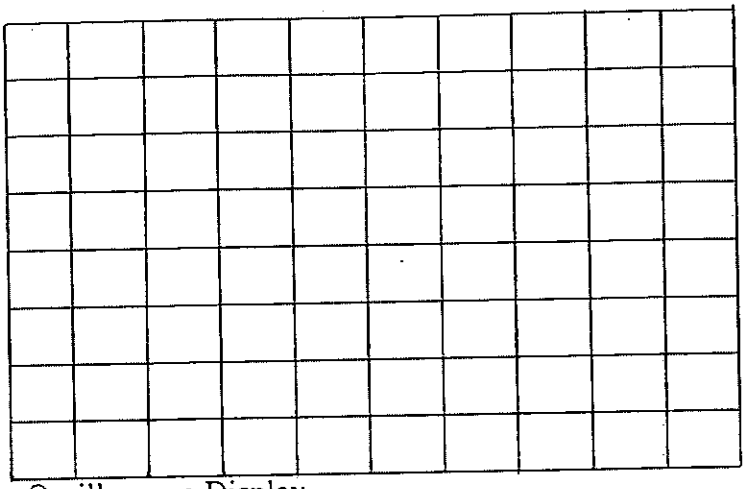
Q1. Using 5 ms/div and 0.5/div scales

(a) Draw a sinusoidal waveform with 2 Vp-p at 100Hz.



Oscilloscope Display

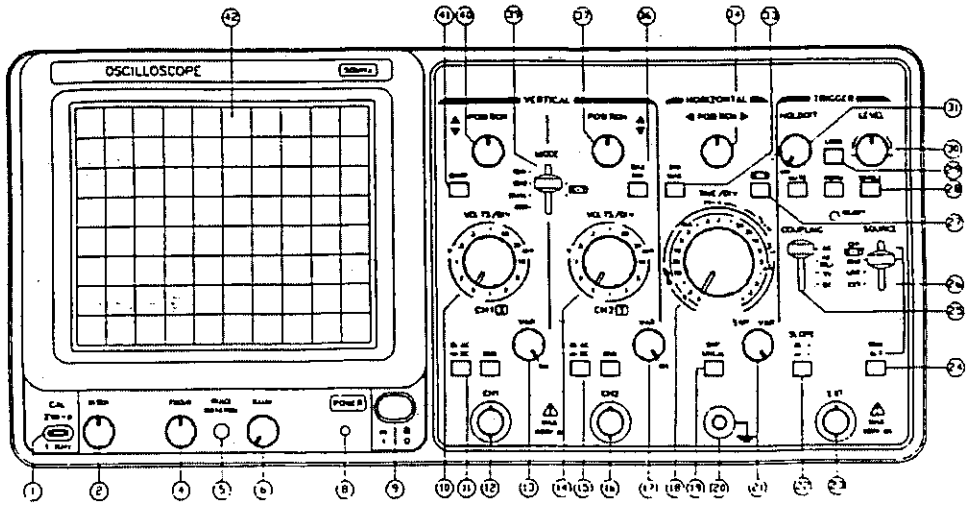
(b) Draw a waveform of any amplitude with one cycle filling 4 div. how many cycles can be seen on the oscilloscope display? What are the p-p and the frequency of the waveform?



Oscilloscope Display

APPENDIX

OSCILLOSCOPE



The following table describes briefly some of the oscilloscope controls.

No.	CONTROLS	FUNCTION
1.	POWER (3)	To switch on oscilloscope
2.	INTEN (4)	To control intensity of trace display
3.	FOCUS (6)	To control sharpness of trace
4.	ILLUM. (8)	Illumination of gratitude
5.	TRACE ROTATION (7)	Horizontal trace parallel with line gratitude
6.	CH1 input (11)	Input signal terminal
7.	CH2 input (18)	Input signal terminal
8.	AC-GND-DC (10), (19)	AC- to display AC signal GND- to ground/zero the signal so that zero line can be calibrated DC – to display the full signal inclusive of DC signal
9.	VOLTS/DIV (120, (16)	Choosing vertical sensitivity in the range of 5 mV/DIV to 5 V/DIV

10.	VARIABLE (13), (17)	Adjusting VOLT/DIV sensitivity. Variable for adjusting the vertical amplitude.
11.	POSITION (9), (20)	Controlling vertical position of trace/signal. (Up/Down of signal display)
12.	VERT MODE (14)	Choosing operation mode: CH1, CH2, DUAL or ADD
13.	EXT TRIG (EXT HOR) 23	Input terminal used to trigger external signal. (Set switch SOURCE to EXT to use this terminal)
14.	SOURCE (26)	To choose internal triggering and input signal EXT HOR.
15.	LEVEL (22)	Adjusting; level of triggering
16.	TIME/DIV (30)	Time scale for signal sweeping from left to right of oscilloscope display
17	POSITION (32)	Control horizontal position of trace/signal
18.	TRIGGER MODE (28)	Choosing triggering mode: AUTO, NORM, SINGLE or PUSH TO RESET
19.	CAL (1)	Terminal output for calibrated signal

The oscilloscope described is a "Dual Trace Oscilloscope Model GOS-652 (GOODWILL)". You can use this as a reference if you are using different type of oscilloscope. The controls described are almost the same but the position of the controls maybe different.