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EXPERIMENT NO 2

FAMILIARIZATION OF VARIOUS INSTRUMENTS LIKE POWER SUPPLY, DIGITAL MULTIMETER, FURNCTION GENERATOR, CRO ETC.

Digital multimeter:~

- INTRODUCTION

A multimeter is an electronic device that is used to make various electrical measurements, such as AC and DC voltage, AC and DC current and resistance. It is called a mutimeter because it combines the function of a voltmeter, ammeter etc.

PARTS OF MULTIMETER

A multimeter has three parts:

- Display
- sdection Knob
- Ports

The display usually has four digits and the ability to display a negative sign. A few multimeters have illeminated display for better viewing in low light situations.

The selection Knob allows the user to set the multimeter to read different things such as

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milliamps (mA) of current, voltage (V) and resistance (Ω).

Two Probes are plugged into two of the Ports on the front of the unit. COM stands for common and is almost always connected to ground or '-' of a circuit. The com Probe is conventionally black but there is no difference between the red Probe and black Probe other than color. mAV-Ω is the Port that the red Probe is conventionally plugged in to. This Port allows the measurement of current (up to 200 mA), voltage (V), and resistance (Ω). The Probe have a banana type connector on the end that plugs into multimeter. Any Probe with a banana plug will work with this meter.

- Input Jacks

The black lead is always plugged into the common terminal. The red lead is plugged into the 10. A Jack when measuring currents greater than 300 mA, the 300 mA Jack when measuring currents less than 300mA, and

the remaining jack (v-ohms-diode) for all other measurements.

- Range Fixing

The meter defaults to autorange when first turned on. You can choose a manual in V AC, V DC, A AC and A DC by pressing the button in the middle of the rotary dial. To return to autorange, press the button for one second.

PRODCEDURE FOR MEASUREMENT

- Voltage measurement

D. C. / A. C. voltage measurement

1) Connect the positive(red) test lead to the 'V/mA' jack socket and the negative (black) lead to the 'COM' jack socket.
2) set the selector switch to the desired mV D. C. / D. C. V. / A. C. V. range.
3) Connect the test leads to the circuit to be measured, the valtage value should appear on the digital display along with the valtage Polarity (if reversed only).

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• Current measurement

1) Connect the positive (red) test lead to the 'V/mA' jack socket and the negative (black) lead to the 'com' jack socket (for measurements up to 200 mA). For measurements between 200 mA and 10 A connect the red test lead to the '10mA' socket.
2) Set the selector switch to the desired μA / mA / A range.
3) Open the circuit to be measured and connect the test leads in SERIES with the load in which current is to be measured.
4) To avoid blowing an input fuse, use the 10 A jack until you are sure that the current is less than 300mA. Turn off power to the circuit. Break the circuit. Put the meter in series with the circuit and turn power on.

• Resistance measurement

1) connect the positive (red) test lead to the 'V/mA' jack socket and the negative (black) lead to the 'com' jack socket.
2) Set the selector switch to the desired 'OHM Ω'

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3) If the resistance to be measured is part of a circuit, turn off the power and discharg-e all capacitors before measurement.
4) Connect the test leads to the circuit to be measured.
5) The resistance value should now appears on the digital display.
6) If the resistance to be measured is part of a circuit, turn off the power and discharge all capacitors before measurement.

- Continuity Test

This mode is used to check if two points are electrically connected. It is often used to verify connectors. If continuity exists (resistance less than 210 ohms), the beeper sounds continuously.
1) Connect the positive (red) test lead to the 'V/mA' jack socket and the negative (black) lead to the 'COM' jack socket.
2) set the selector switch to the [•))] position.
3) Connect the test leads to two points of the circuit to be tested. If the resistance is ohms the buzzer will sound.
4) If the resistance to be measured is part of

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a circuit, turn off the power and discharge all capacitors before measurement.

- Diode test

1) Connect the positive (red) test lead to the 'V/mA' jack socket and the negative (black) lead to the 'COM' jack socket.
2) Set the selector switch to the position.
3) Connect the test leads to be measured
4) Turn on the power to the circuit to be measured and the voltage value should appear on the digital display.

◉ General operation

- Connection of Probes

All multimeters come with two probes. They are to be connected to the terminals on the meter itself. The Black probe is to be connected to the COM terminal. Red probe is to be connected to terminal marked with: 'V' - for voltage measurement, 'mA' or '20A' for current measurement (there are two terminals, one for 2A range and the other for 20A range) 'Ω' for resistance measurement.

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- **Setting of function**

The multimeter uses different circuits internally to measure different. Therefore, you must select the correct function before using it.

- **setting of Range**

You can change the sensitivity of the meter by selecting different range for measurement. Set the range to the first range that is higher than the maximum value you expect to measure. This will give a more accurate reading. If you do not know what to expect, use the highest range first. After a reading is obtained, set the range to the appropriate one to get a better reading. When the value measured exceeds the existing range, the display will flash. When this happens, set the multimeter to a higher range until some values are displayed.

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◉ Resistance measurement

1) Connect Probes: black Probe to COM terminal an red Probe to terminal marked with on Dmm.
2) Set function to resistance measurement.
3) Set to the appropriate range.
4) Connect the two Probes' crocodile clips to the resistor to make measurement.
5) Note the reading, adjust range if necessary
6) Take the more accurate reading.

◉ voltage measurement

• Procedure

7) Connect Probes: black Probe to COM terminal and red Probe to terminal marked with 'V'
8) Set function to voltage measurement.
9) Set to the appropriate range.
10) Touch the two Points where you want to make measurement.
11) Note the reading, adjust range if necessary
12) Take the more accurate reading.

◉ current measurement

• Procedure

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1) Connect Probes : black Probe to COM terminal and red Probe to terminal marked with 'A'.
2) set function to current measurement.
3) set to the appropriate range.
4) set AC-DC selection - depends on what type of signal you want to measure
5) off the power to the circuit.
6) Break the path which we want to make measurement.
7) Connect the path with two Probes so that current now flow through the multimeter
8) on the power
9) Note the reading, change range if necessary
10) Take the more accurate reading.

2B DC VARIABLE POWER SUPPLY

- objective:

To study the function and operation of regular power supply.

- Equipment required
  - multimeter
  - Dual Dc variable regulated power supply (0 - 30) volts

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DC Power Supply:

- main function

1) output constant current adjustable.
2) output constant voltage adjustable.
3) LCD voltage and current operation in individual.
4) LCD voltage and current display.
5) over current protection.

Adjustable power supply.

CATHODE - RAY OSCILLOSCOPE (CRO)

- objective
- TO introduce the basic structure of a cathode - ray oscilloscope.
- TO get familiar with the use of different control switches of the device.
- TO visualize an ac signal, measure the amplitude and the frequency.
- Equipment Required:
  - cathode - ray oscilloscope
  - Function Generator
  - BNC Connector

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- Procedure:

1) Turn on the oscilloscope
2) Adjust the intensity and the focus of the trace.
3) Use the x and y knobs to center the trace horizontally and vertically.
4) Connect the cable from ch1 of the CRO to function generator.
5) A signal will appear on the screen.
6) Make sure that the inner red knobs of the volt/Div and the Time/Div are locked clockwise.
7) Set the frequency of the generator to 100 Hz.
8) Adjust the volt/Div and Time/Div knobs so that you get a suitable size signal.
9) Count the number of vertical squares lying within the signal, then calculate the peak value.
10) Count the number of horizontal squares lying within the one Duty cycle, then calculate time value.
11) calculate the frequency of signal by using the formula: Freq = 1/Time

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⊙ Signal generator

A signal generator, also known as a test signal generator, function or frequency generator is an electronic device that generates different types of wave from of selective frequency and amplitude (either in the analog or digital domain). The common signals are generally sinusoidal, square or rectangular, triangular and saw both wave forms. They are generally used in designing, testing, troubleshooting and repairing electronic or electroacoustic devices: though they often have artistic uses as well.

- **Setting up a signal generator and generating a particular signal.**

1) Before switching on the equipment ensure that all knobs are in minimum position.
2) Press 'Power' button to switch on the function generator.
3) Do not connect the input lead at this stage.
4) Select either Frequency or Amplitude with the help of FREQ/AMP push button.
5) To select particular frequency, select the range with push button and then frequency can be adjusted with the help of FVAR knob (vary from Hz to several GHz).

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6) To select particular amplitude, adjust with AMP Knob.
7) Ensure that 50Ω/600Ω should be at 50Ω position.
8) Select the waveform with FUNCTION switch/ MODE SELECTION switch.
9) Connect output BNC connector with CRO to find the frequency and amplitude selected in signal generator.
10) Two - 20 dB attenuators can be used by Pressing each push button separately or when both are activated. Total attenuation will be -40 dB. It is used to select the voltages below 2 volt in amplitude i.e. if -20dB is used by Pressing each push button, the voltage at the display will be 0.2 volt.
11) Do not apply any DC voltage to the output Socket.

◉ CRO (Cathode Ray Oscilloscope)

An oscilloscope is a test instrument, which allows us to look at the shape of electrical signals by displaying a graph of voltage against time on its screen. It is like a voltmeter with the valuable extra function of showing how the voltage varies with time.

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• Setting up a CRO:

1) Switch on the oscilloscope to warm up (it takes a minute or two).
2) Do not connect the input lead at this stage.
3) set the AC/GND/DC switch (by the y input) to DC.
4) set Trigger Level to Auto.
5) Adjust y SHIFT (up/down) and X SHIFT (left/right) to give a trace across the middle of the screen like the picture.
6) Adjust INTENSITY (brightness) and FOCUS to give a bright shape trace.

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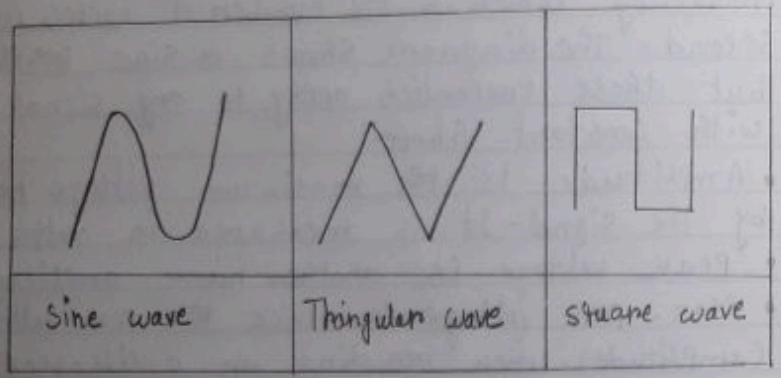
⊙ measuring voltage and time period:

The trace on an oscilloscope screen is graph of voltage against time. The shape of this graph is determined by the nature of the input signal. In addition to the properties labeled on the graph there is frequency, which is the number of cycles per second. The diagram shows a sine wave but these properties apply to any signal with constant shape.

- Amplitude is the maximum voltage reached by the signal. It is measured in volts V.
- Peak voltage is another name amplitude.
- Peak - peak voltage is twice the peak voltage (amplitude). when reading an oscilloscope trace it is usual to measure peak - peak voltage.
- Time period is the time taken for the signal to complete one cycle. It is measured in second (s) but time periods tend to be short so milliseconds (ms) and microseconds (μs) are often used. 1ms = 0.001 s and 1μs = 0.000001 s.
- Frequency is the number of cycles per second. It is measured in hertz (Hz), but frequencies tend



Sine wave	Thingular wave	square wave

Measuring frequency and amplitude of different typs of signal from CRO

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to be high so kilohertz (KHZ) and megahertz (MHZ) are often used 1KHZ = 1000 HZ and 1 MHZ = 1000000 HZ.

• observation table:

FREQ (Hz)	AMP (V)	FREQ (Hz)	AMP (V)
500HZ	250 mV	500 HZ	0.5 V
1KHZ	500 mV	1KHZ	0.4V
25 KHZ	1.5 V	25KHZ	0.3V
50 KHZ	7.5V	50KHZ	0.32V
1 MHZ	10V	1 MHZ	0.2V

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