Report: Assignment 1

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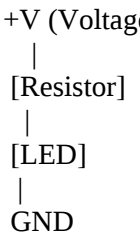
Title of Experiments: Introduction (Essential Electronic Lab Instruments)

Brief Description: This report provides detailed solutions to questions on the use of Multimeter, CRO, Function Generator, and Voltage Generator. It covers waveform generation, measurement techniques, circuit design, and safety precautions, with expanded explanations and visual aids.

Schematic diagram (for Q4)



Results:

Q1. What types of waveforms can a standard function generator produce?

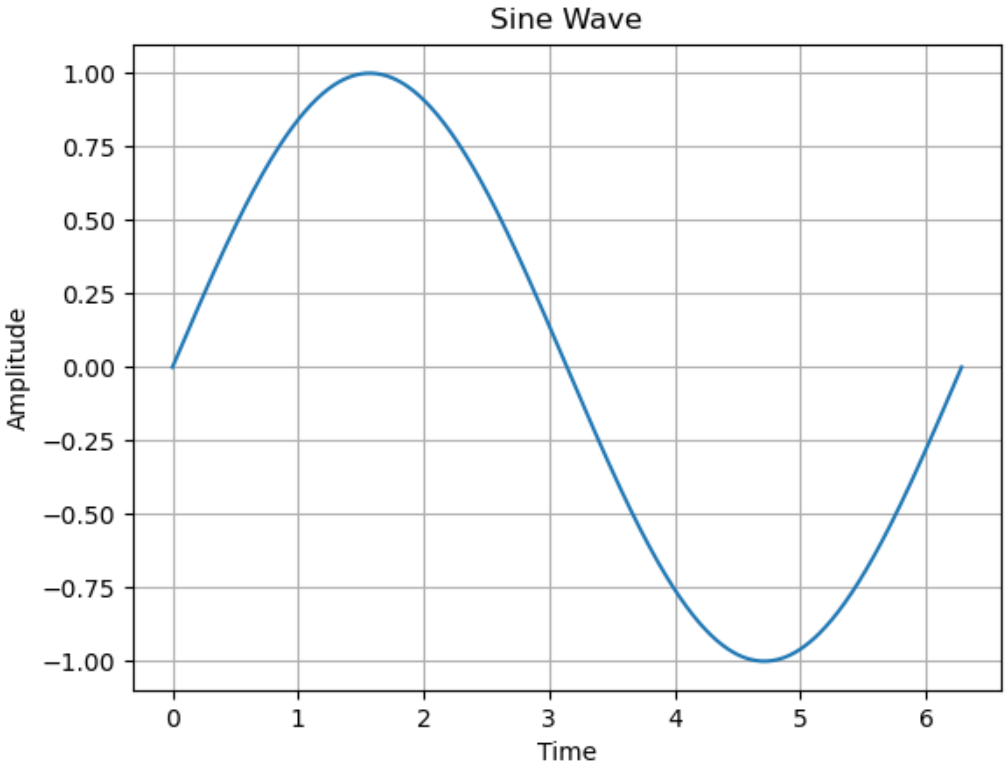
A standard function generator can produce several types of waveforms, including:

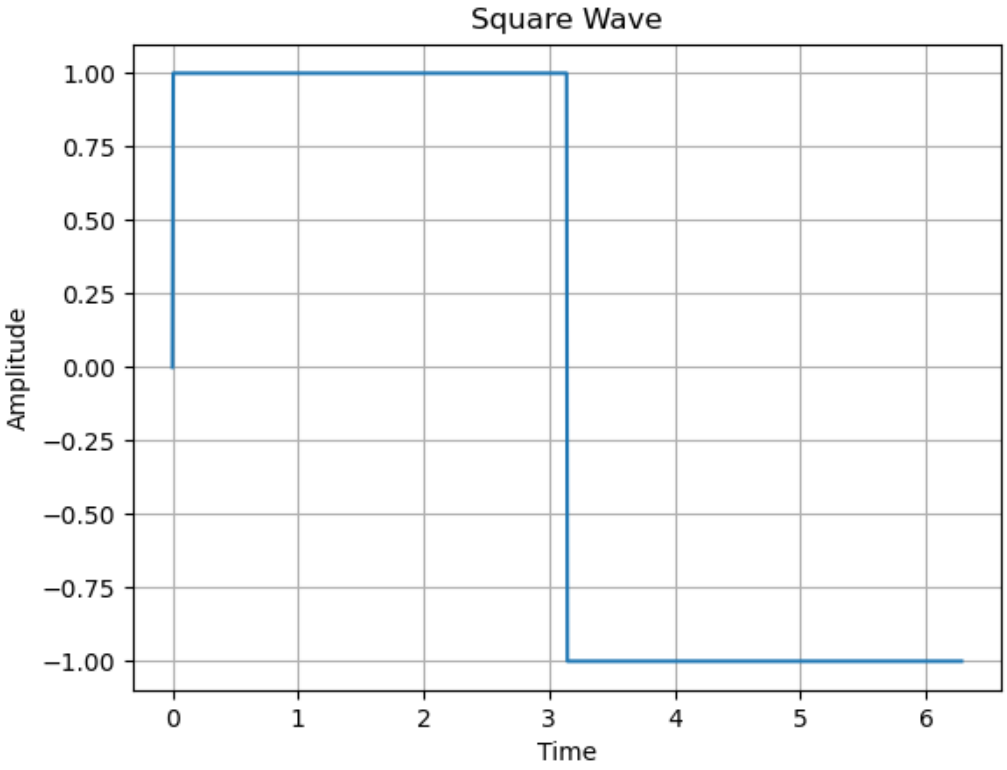
- Sine wave: Smooth periodic oscillation, used for testing amplifiers and filters.

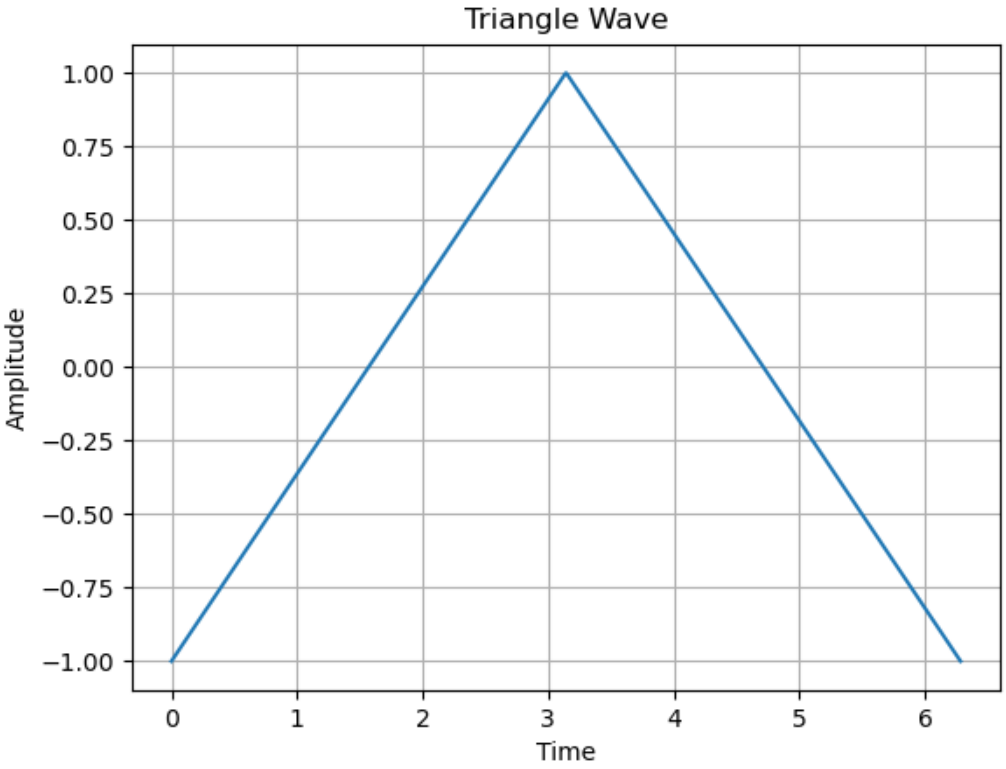
- Square wave: Alternates between high and low levels, useful for digital circuits and timing analysis.

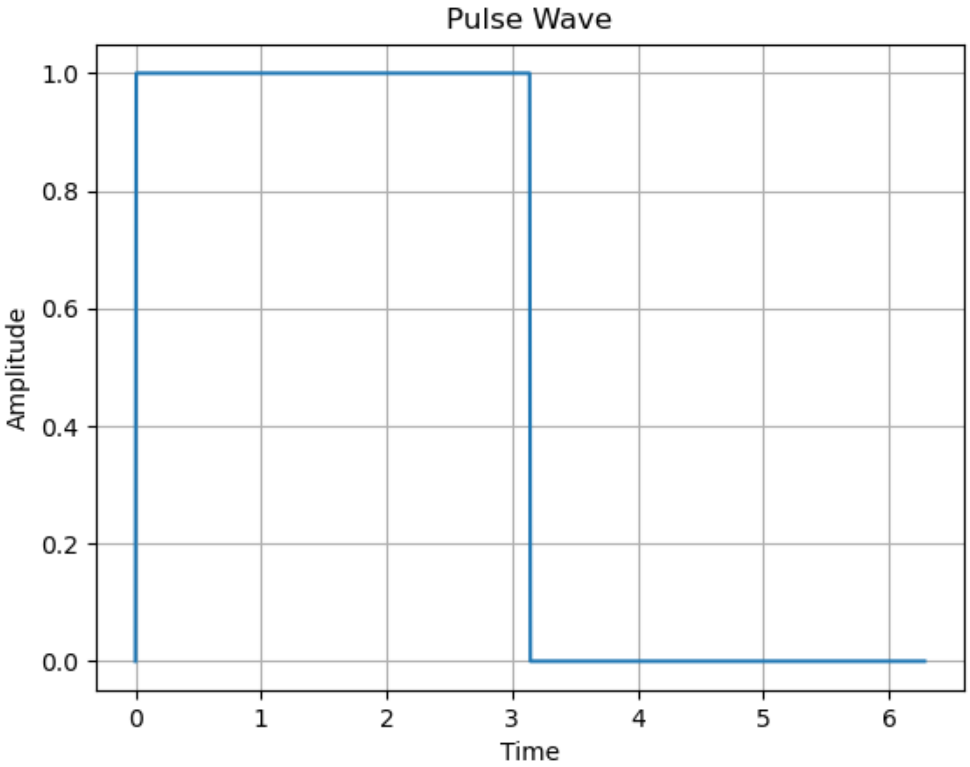
- Triangle wave: Linear rise and fall, used for testing linearity and response of circuits.

- Pulse wave: Short bursts, used for triggering and timing applications.


Sine Wave
Amplitude
Time
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
1
2
3
4
5
6


Square Wave
Amplitude
Time
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
1
2
3
4
5
6


Triangle Wave
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
Amplitude
0
1
2
3
4
5
6
Time


Pulse Wave
1.0
0.8
0.6
0.4
0.2
0.0
Amplitude
0
1
2
3
4
5
6
Time

Q2. How do you set a desired frequency and amplitude?

To set a desired frequency and amplitude on a function generator:

- Use the frequency knob or digital input to select the required frequency. Some generators allow fine and coarse adjustments.

- Set the amplitude using the amplitude/level knob or digital controls. Ensure the output matches the requirements of your circuit.

- Verify settings using a CRO or multimeter to confirm output values.

- For precise control, refer to the generator's display and calibration settings.

Q3. Using a multimeter, explain the steps to measure: a) DC voltage across a resistor. b) Resistance of a component without damaging the device.

Using a multimeter, the steps to measure:

a) DC voltage across a resistor: - Ensure the circuit is powered. - Set the multimeter to DC voltage mode (V with straight line). - Place the probes across the resistor terminals. - Read the voltage displayed; this is the potential difference across the resistor.

b) Resistance of a component without damaging the device: - Power off and disconnect the component from the circuit. - Set the multimeter to resistance (Ohm) mode. - Place probes across the component. - Read the resistance value. Avoid measuring in-circuit to prevent parallel paths affecting the reading.

Q4. Design a simple circuit using a voltage generator, resistor, and LED

- Connect the positive terminal of the voltage generator to one end of the resistor.

- Connect the other end of the resistor to the anode (longer leg) of the LED.

- Connect the cathode (shorter leg) of the LED to ground.

- Choose resistor value to limit current (e.g., 330 Ohm for 5V supply).

Voltage Generator (+V) ----[Resistor]----|----[LED]---- Ground

Q5. Show how you would use a multimeter to check if the LED is receiving appropriate voltage

- Set the multimeter to DC voltage mode.

- Place the probes across the LED terminals while the circuit is powered.

- The reading should be close to the LED's forward voltage (typically 1.8V–3.3V depending on type). If voltage is too low, check connections and resistor value.

Q6. How can a CRO be used to measure the frequency and amplitude of a waveform?

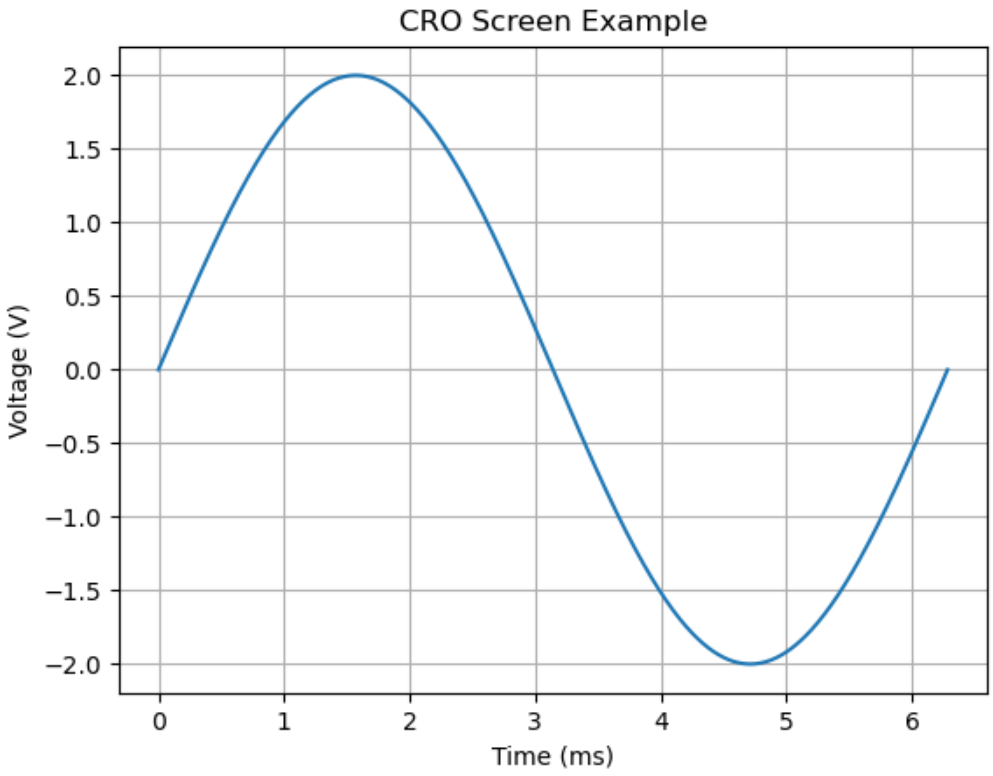
- Connect the signal output to the CRO input channel.

- Adjust vertical (voltage) and horizontal (time) scales for clear display.

- Measure peak-to-peak voltage using vertical divisions and the volts/div setting.

- Measure time period of one cycle using horizontal divisions and the time/div setting.

- Calculate frequency: Frequency = 1 / Time Period.



Q7. Define and explain the significance of the following terms: a. Peak Voltage b. RMS Voltage c. Frequency d. Duty Cycle

a. Peak Voltage: The highest instantaneous value of a waveform. Important for determining maximum stress on components.

b. RMS Voltage: Root Mean Square value, represents effective voltage for AC signals. Used for power calculations.

c. Frequency: Number of cycles per second (Hz). Determines signal timing and behavior in circuits.

d. Duty Cycle: Percentage of one period in which a signal is active (high). Critical for pulse and digital signals.

Q8. Why should a multimeter never be used to measure current in parallel with a component? What might happen?

- Measuring current in parallel creates a short circuit path, bypassing the component.
- This can result in high current flow, damaging the multimeter and the circuit.
- Always measure current in series with the component.

Q9. List at least three precautions to be followed when using a function generator in a lab

- Always check the output voltage and waveform before connecting to a circuit.
- Do not exceed the voltage/current ratings of connected components.
- Ensure all connections are secure and the generator is properly grounded.
- Turn off the generator before making or changing connections.

Q10. A DC power supply shows +12V on the display. You connect a multimeter and it reads +11.5V. What could be the reasons for this difference?

- Calibration error in either the power supply or multimeter.
- Voltage drop due to load resistance or wiring.
- Measurement accuracy and resolution differences.
- Contact resistance at terminals or connectors.

Discussion: This assignment provides a comprehensive overview of essential lab instruments and their correct usage. Accurate measurement and safe operation are vital for reliable results and equipment longevity. Diagrams and waveforms help visualize concepts and reinforce understanding.