**Basic Electronics**

**Course Code GE101**

**Lab 2 Manual**

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**Introduction to Electronics Kit**

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**Tinker cad for Circuit Simulation**

**Department of Computer Science**

**University of Central Punjab**

**Objective:**

* To familiarize students with an electronics kit containing basic components and tools used in electronics.
* To introduce the use of a multimeter for circuit measurements.
* To provide an overview of Tinkercad.com for virtual circuit design and simulation.

**Electronics Kit Components:**

* Multimeter
* Breadboard
* Connecting Wires
* 9V Battery and Battery Cap
* Cell and Casing
* Resistors (different ranges)
* LEDs (various colors)
* Potentiometer
* PN Junction Diodes
* Zener Diodes
* BJT Transistors
* Logic Gates ICs (AND, OR, NOT)
* Seven-Segment Display
* Mini Push Buttons
* Buzzer
* Microphone
* Software:
* Tinkercad.com account for virtual circuit design and simulation.

**Pre-Lab Reading:**

* Basics of electrical components: resistors, LEDs, diodes, transistors, and logic gates.
* Introduction to breadboard usage.
* Overview of Tinkercad.com and its virtual electronics workspace.

**Lab Procedure:**

**Part 1: Introduction to the Electronics Kit**

**Step 1: Overview of the Components**

1. **Resistors**: Identify resistors of different values from the kit and review their color code.
2. **LEDs**: Explore LEDs of various colors. Learn about their polarity (anode and cathode).
3. **Potentiometer**: Understand how to adjust resistance with a potentiometer.
4. **Diodes (PN Junction and Zener)**: Learn the basic function of diodes and differentiate between PN junction and Zener diodes.
5. **Transistors**: Explore Bipolar Junction Transistors (BJTs) and understand their terminals (collector, base, and emitter).
6. **Gates ICs**: Review the basics of AND, OR, and NOT logic gates.
7. **Seven-Segment Display**: Understand how to use a seven-segment display.
8. **Mini Push Buttons and Buzzer**: Examine their function in a circuit.
9. **Microphone**: Learn the purpose of a microphone in electronic circuits.

**Task 1:**

***Pick out each component from the kit and familiarize yourself with its function. For each component, write down its main purpose in a circuit.***

**Part 2: Using the Multimeter**

**Step 1: Understanding Multimeter Modes**

Power on the **Multimeter** and familiarize yourself with its various modes:

* DC Voltage Measurement (V).
* AC Voltage Measurement (V).
* Current Measurement (A).
* Resistance Measurement (Ω).
* Continuity Test (using the buzzer symbol).

**Step 2: Measuring Components**

1. **Measure the Resistance**: Using the multimeter, measure the resistance of three resistors from your kit. Record the values and compare them with their color-coded nominal values.
2. **Test the LED**: Set the multimeter to the **diode testing mode** and check the forward voltage of a red LED.
3. **Check Battery Voltage**: Use the multimeter to measure the voltage of a 9V battery.

**Task 2:**

***Use the multimeter to measure the resistance of a 1kΩ, 10kΩ, and 100Ω resistor. Then test a diode and measure the voltage of the 9V battery. Document your measurements.***



**Part 3: Building a Basic Circuit on a Breadboard**

**Step 1: Assemble an LED Circuit**

1. Place an **LED** and a **1kΩ resistor** on the breadboard.
2. Connect the **9V battery** to the breadboard using the battery cap.
3. Ensure the correct orientation of the LED (anode to positive, cathode to negative).
4. Use connecting wires to complete the circuit.

**Step 2: Test the Circuit**

1. Once connected, the LED should light up. If it doesn’t, check the connections and the polarity of the LED.



**Task 3:**

***Build the LED circuit on the breadboard and verify its functionality. Take note of any troubleshooting steps you needed to follow.***

**Part 4: Introduction to Tinkercad for Circuit Simulation**

**Step 1: Setting up Tinkercad**

1. Go to Tinkercad.com and create a free account if you don’t have one.
2. Navigate to the **Circuits** section of Tinkercad.

**Step 2: Creating a Virtual Circuit**

1. Place a virtual **breadboard**, an **LED**, a **resistor**, and a **battery** in the Tinkercad workspace.
2. Connect the components just as you did with the physical breadboard circuit.
3. Run the simulationto see if the LED lights up in the virtual environment.

**Step 3: Exploring Simulation Features**

1. Modify the resistor value in the simulation to see how it affects the brightness of the LED.

2. Experiment with other components from the kit, like adding a push button to control the LED.

**Task 4:**

***Replicate the LED circuit virtually on Tinkercad and test its functionality using the simulation. Explore the differences between virtual and physical circuit behaviour. Document your experience.***

**Task 5:**

***Create a simple LED circuit with a battery, resistor and LED. What is minimum voltage require for the LED to turn on?***

**Task 6:**

***Build a series circuit with two resistors of 1 kΩ and 2 kΩ and a battery of 9V.***

**Task 7:**

***Build a series circuit with two resistors of 1 kΩ and 2 kΩ and a multimeter. Calculate the total resistance? How does the total resistance change when you add more resistors?***

**Task 8:**

***Design a series circuits with three resistors of 1 kΩ, 2 kΩ and 3 kΩ.and a multimeter. Calculate the total resistance.***

**Task 9:**

***Design a parallel circuit with two LED’s, two resistors of 1 kΩ each and a battery of 9V? What happens if one LED is disconnected?***

**Post-Lab Questions:**

1. What are the advantages of using Tinkercad for circuit simulation compared to building circuits physically?
2. How can a multimeter help you troubleshoot circuits?
3. What role does a breadboard play in prototyping electronic circuits?
4. How does changing the value of a resistor in the LED circuit affect the brightness?

**Task 10:**

***Answer the post-lab questions in your lab report.***

**Conclusion:**

In this lab, you were introduced to the components and tools in an electronics kit and learned how to use a multimeter for basic measurements. You also built a simple LED circuit on a breadboard and explored the virtual circuit simulation environment in Tinkercad. These skills will be fundamental as you progress in understanding and designing more complex electronic circuits.

**Lab Report Guidelines:**

Your lab report should include:

* A list of components from the electronics kit and their functions.
* Step-by-step description of the procedures for using the multimeter, breadboard, and Tinkercad.
* Screenshots of the circuit built in Tinkercad.
* Answers to the post-lab questions.
* Conclusion summarizing the lab experience.

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**Instructor Notes:**

* Ensure students have access to the required components from the electronics kit.
* Guide students through setting up their Tinkercad accounts and help them navigate the circuit simulation workspace.
* Encourage students to explore additional features of the multimeter for more advanced measurements.

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