

ECE 281  
Electrical Circuits and Instrumentation + Laboratory  
Fall 2016/2017  
LAB # 7

14.11.2016

**Objective:**

1. To study R/2R ladder network
  2. Find the internal resistance of a battery cell.
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**1. To study R/2R ladder network (50 Points)**

**Procedure:**

1. Construct the ladder circuit shown in Figure 1 with three input nodes.
2. Use a digital multi-meter to measure voltages and resistances.

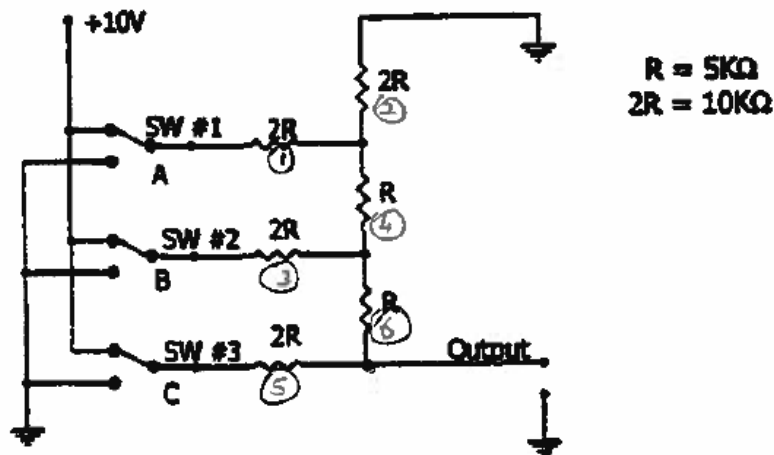


Figure 1

3. When switch is “ON” connect A, B and C to 10V. When switch is “OFF” connect points to the ground.
4. Construct the Table 1 by filling the voltage values for the given switch position combinations.

Switch 1 (SW1)	Switch 2 (SW2)	Switch 3 (SW1)	Voltage
OFF	OFF	OFF	
OFF	OFF	ON	
OFF	ON	OFF	
OFF	ON	ON	
ON	OFF	OFF	
ON	OFF	ON	
ON	ON	OFF	
ON	ON	ON	

**Table 1**

- Now, remove the power supply and construct the Table 2.
- “ON” do not connect node to anywhere. “OFF” connect node to the ground.

Switch 1 (SW1)	Switch 2 (SW2)	Switch 3 (SW1)	Resistance
OFF	OFF	OFF	
OFF	OFF	ON	
OFF	ON	OFF	
OFF	ON	ON	
ON	OFF	OFF	
ON	OFF	ON	
ON	ON	OFF	
ON	ON	ON	

**Table 2**

- Check the following values

$$\text{Lowest voltage} \cong 0$$

$$\text{Highest Voltage} = \frac{2^N - 1}{2^N} \cdot V_{\text{source}}$$

$$N = \text{number of switch points}$$

## 2. Find the internal resistance( $R_s$ ) of a battery cell.(50 Points)

### Procedure:

1. Construct the circuit shown in Figure 2.

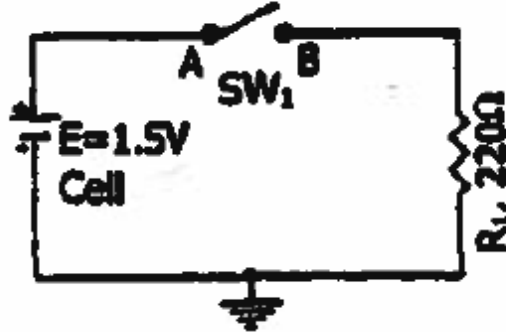


Figure 2

2. Use a digital multi-meter to measure voltages and currents.
3. With the switch (SW1) “OPEN” measure voltage between point A and ground (E).
4. “CLOSE” switch, again measure voltage between point A and ground ( $V_L$ ).
5. Measure current between A-B( $I_L$ ).
6. Calculate the internal resistance of a battery cell ( $R_s$ )
7. Construct Table 3. Draw the theoretically correct circuit. By replacing E with  $V_L$  and  $R_s$ .

Voltage with SW1 OPEN	E		<b>Circuit Box</b>
Voltage with SW1 is CLOSE	$V_L$		
Current out of the cell	$I_L$		
<b>Calculation Box</b>			
$R_s = \frac{E - V_L}{I_L}$			