جامعة بيرزيت

BIRZEIT UNIVERSITY

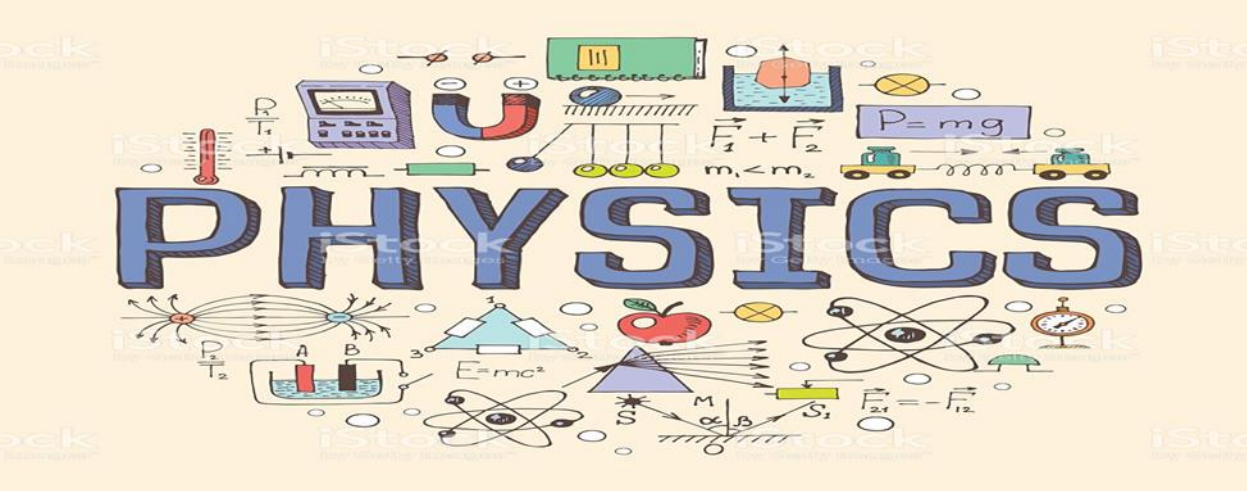
**Physics Department**

**Physics 112**

***Report 2***

***Done by :Rayan Ghnimat***

*"The world is a book and those who do not travel read only one page."*



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"وَقُل رَّبِّ زِدْنِي عِلْمًا"

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Physics Department

Physics 112

Experiment No.2

# Source Internal Resistance, Loading Problems and Circuit Impedance Matching.


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Section: 6.

Date: 16/11/2022.

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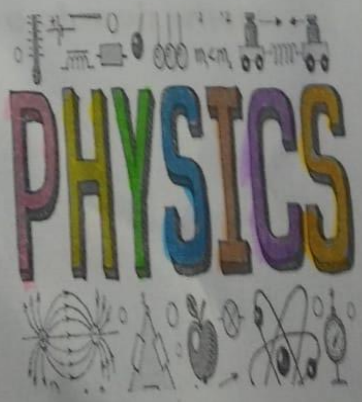


- **Abstract:**

1. **The aim of the experiment:** is to measure the internal resistance of a voltage source, the potential difference, and see when does the power reach its maximum value.
2. **The method used:** The direct calculation of the electrical current passing through a simple circuit at different values of the resistance.

**3.Main results:**

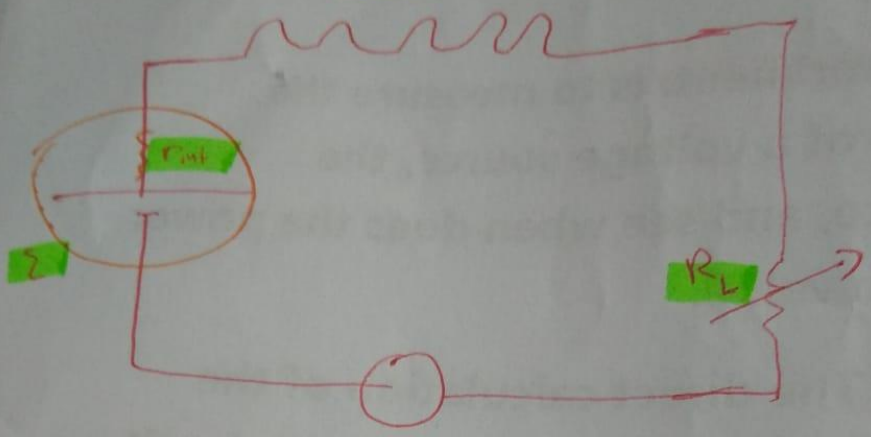
$\mathcal{E} = 0.11\ V$

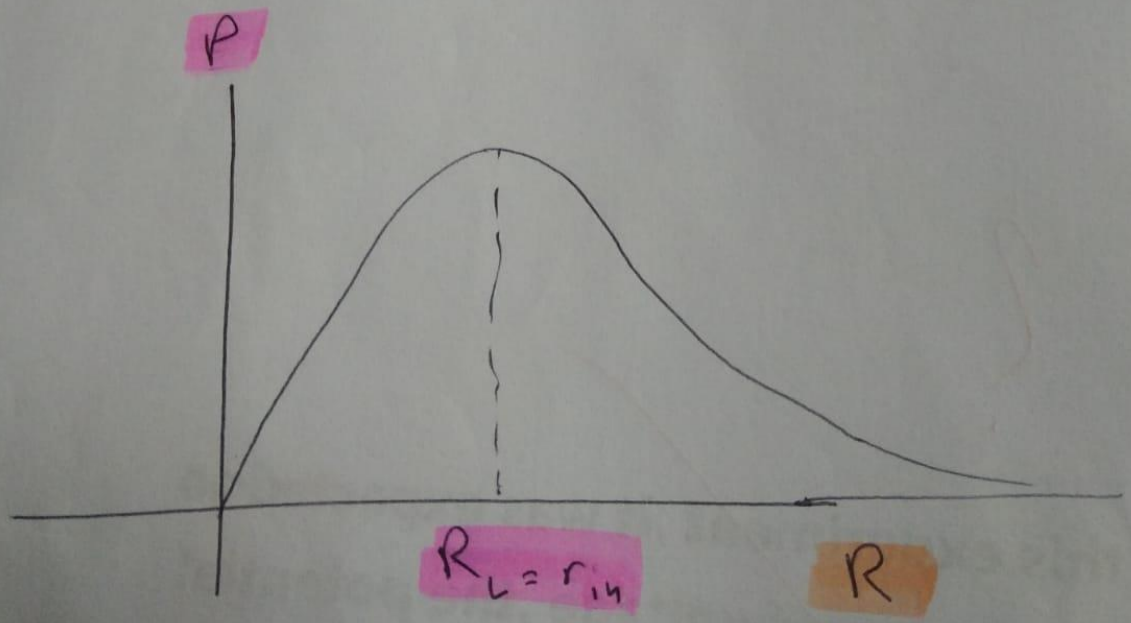
$r_{in} = 500\ \Omega$

?

**Introduction : In this experiment ,it was expected to find the internal resistance of voltage ,the potential difference ,and the maximum value of power ,we can find them by ghraphing 2 graphs ,first one $R_L$ vs. $I^{-1}$ and the second one is expected to have ghraph where maximum value of power is known .**

$\Sigma R_{in} = R + r_{in}$



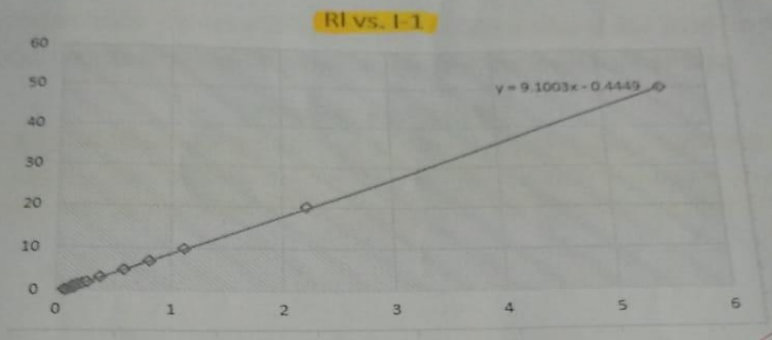



Data:

| $R_l$(KΩ) | I(mA) | $I^{-1}(mA)^{-1}$ | $I^2(mA)^2$ | $P_l = I^2R_L$(mW) |
|---|---|---|---|---|
| 0.1 | 15.08 | 0.07 | 227.41 | 22.74 |
| 0.3 | 11.41 | 0.08 | 130.19 | 39.06 |
| 0.5 | 9.17 | 0.11 | 84.09 | 42.05 |
| 0.7 | 7.67 | 0.13 | 58.83 | 41.18 |
| 0.8 | 7.09 | 0.14 | 49.84 | 39.87 |
| 0.85 | 6.84 | 0.15 | 46.79 | 39.77 |
| 0.9 | 6.60 | 0.15 | 39.69 | 35.72 |
| 0.95 | 6.37 | 0.16 | 40.58 | 38.55 |
| 1.0 | 6.12 | 0.16 | 37.45 | 37.45 |
| 1.05 | 6.01 | 0.17 | 36.12 | 37.93 |
| 1.1 | 5.80 | 0.17 | 33.64 | 37.0 |
| 1.2 | 5.45 | 0.18 | 29.7 | 35.64 |
| 1.5 | 4.64 | 0.22 | 21.53 | 32.30 |
| 2.0 | 3.72 | 0.27 | 13.83 | 27.66 |
| 3.0 | 2.66 | 0.38 | 5.43 | 16.29 |
| 5.0 | 1.70 | 0.59 | 2.89 | 14.45 |

## Data Analysis: Linear Graph of $R_i$ vs. $I^{-1}$:

$R_i(K\Omega)$




$I^{-1}(mA)$

## -Calculations of Graph 1:

slope from graph = 4.1

$\mathcal{E}$ = 1/slope = 1/4.1 ≈ 0.11 Volt.

$r_{in} = R_{in} - R$ (where R is 1KΩ making it 1000).

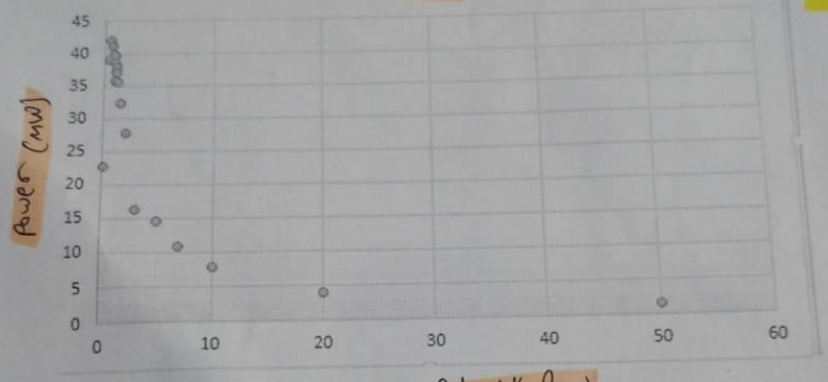
$r_{in} = (0.5 \times 1000) - 1000 = -500$

$r_{in} = 500\ \Omega$

(The graph was done without connecting the dots due to the fact that excel does not have a proper trendline for it).

**Graph of P vs. $R_l$**

(*) The maximum power transfer to the load resistance occurs where $R_L = 1000\,\Omega$ which is approximately equal to total internal resistance. This confirms our conclusion about impedance matching which occurs at $R_L = \Sigma R_{in}$.




From graph of $P(R_L)$:

(*) Max value for P occures at $R_L = 1000\,\Omega \Rightarrow P_{max} \approx 37.45$

**Conclusion:**

**After conducting the experiment, it was found that the RL vs. I-1 graph was in fact a linear graph , therefore, I measured the slope of the graph using 1 /ε .In addition to this, it was also found that the P vs. RL graph was a non-linear graph with the maximum value of the power( $P_{max} = 37.45$ mW) .**