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BIRZEIT UNIVERSITY

Physics Department

## Physics 112

**Experiment No. 2**

**Impedance Matching and Internal Resistance**

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* Abstract :
* **The aim** **:** To find the value of the load resistance RL that satisfies the condition of the maximum power transfer which is RL = R + rin.
* **The method :** The direct calculation of the electrical current passing through a simple circuit at different values of the resistance so we start making the circuit and connecting their elements with each other, we connect a battery that have a voltage of a 10 volts “Є” with a constant resistor of 1000 Ω “R” and then connect the constant resistor with the adjustable resistor “RL” that is the load resistor.
* **The main Result :**
* **From graph 1 (1/I vs RL):**

Slope of line = 1/E = 0.0996.

E = 1/Slope = 10.03 volt .

y-intercept = ∑R/E = 0.092 mA-1 = 92.6 A-1.

∑R = (R + rin ) = 922 Ω .

* **From graph 2 (P vs RL) :**

Pmax = 24.9001 mW.

RL = ( R + rin ) = (1 K Ω) = 1000 Ω.

* **Introduction :**

A voltage source is characterized by its electromotive force and the maximum value of the current it can deliver to short circuit .

In this experiment, it was expected to measure the internal resistance of the voltage, the potential difference , and the maximum value of the power. This would be done by graphing two graphs, where one is expected to be a linear graph of RL vs I-1, and the second is expected to have a graph where the maximum value of the power, is known.

* Data



* Data Analysis :
* **Calculations of Graph 1 :**
* Slope = = = 0.0996
* E = 1/(Ans before rounding ) = 10.03 volt.
* y-intercept = ∑R/E = 0.092 mA-1 = 92.6 A-1.
* ∑R = (R + rin ) = y-intercept \* E = (0.092 \* 10.03 ) = 0.9227 volt / mA

=922Ω .

* rin =∑R - R (where R is 1KΩ making it 1000 ).

rin = 922 – 1000 = -78 Ω .

* **Calculations of Graph 2 :**
* We see from figure (power versus resistance) that the maximum value for p occurs at RL equal (1) KΩ p max equal (24.9001) mW .
* **And the maximum power is when :**

RL = (R+ rin) = (1k KΩ) = (1000 Ω).

Rin = RL – R = 1000 – 1000 = 0 Ω

* Result and conclusion :
* There should be an internal resistance in every circuit .
* To reach the maximum value of the power transferring the load resistance should be equal to the sum of the additional resistance and the internal resistance.
* Our Result of (R+ rin) from Linear graph = 922 Ω and (R+ rin) from semi log = 1000 Ω .

We noticed that difference in values of (R +rin) that occurred due to Systemetic errors and random errors.