Experimental General Physics for Engineers II

Laboratory Report PHYS 194 summer 2022

Section: __L01___

Experiment name: Transformers

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Date submitted:	15/6/2022

Table of results (1.25 pts)	
Graph (1.25 pts)	
Data analysis (2 pts)	
Discussion (0.5 pt)	
References	
Others	
Report Grade (5 pts)	

1. Results

1.1. Geometry of the coils

Number of turns n of the primary coil: n_p= **300 turns**

Number of turns n_s of the secondary coil: n_s= **600 turns**

Which type of transformers you are using

Step up transformer

1.2. Efficiency as a function of load

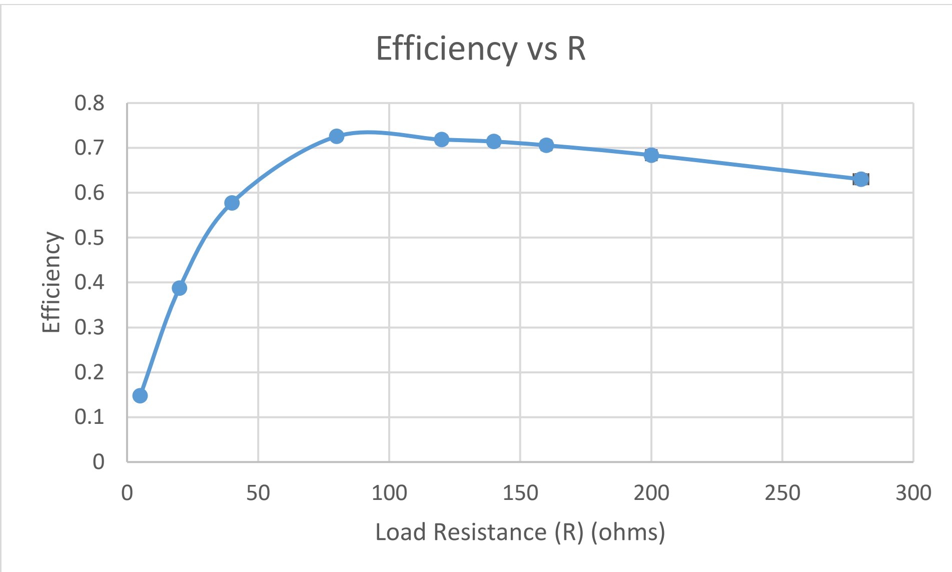
R_L (Ω)	u(R_L) (Ω)	Vp (volt)	u(Vp) (volt)	Ip (A) (ampere)	u(Ip) (A) (ampere)	Vs (volt)	u(Vs) (volt)	Is (A) (ampere)	u(Is) (A) (ampere)
5	±0.05	6.97	±0.01	0.6877	±0.0001	2.15	±0.01	0.3292	±0.0001
20	±0.2	6.90	±0.01	0.5942	±0.0001	5.72	±0.01	0.2780	±0.0001
40	±0.4	6.91	±0.01	0.4718	±0.0001	8.71	±0.01	0.2162	±0.0001
80	±0.8	6.74	±0.01	0.3230	±0.0001	11.18	±0.01	0.1413	±0.0001
120	±1.2	7.03	±0.01	0.2439	±0.0001	12.15	±0.01	0.1014	±0.0001
140	±1.4	7.05	±0.01	0.2194	±0.0001	12.41	±0.01	0.0890	±0.0001
160	±1.6	7.06	±0.01	0.2003	±0.0001	12.60	±0.01	0.0792	±0.0001
200	±2.0	7.08	±0.01	0.1720	±0.0001	12.87	±0.01	0.0647	±0.0001
280	±2.8	7.11	±0.01	0.1394	±0.0001	13.15	±0.01	0.0475	±0.0001

R_L (Ω)	P_{in} (watts)	u (P_{in}) (watts)	P_{out} (watts)	u (P_{out}) (watts)	η	u(η)
5	4.79	±0.007	0.708	±0.003	0.147	±0.002
20	4.10	±0.006	1.590	±0.003	0.387	±0.004
40	3.26	±0.005	1.883	±0.002	0.577	±0.006
80	2.17	±0.003	1.580	±0.002	0.725	±0.008
120	1.71	±0.002	1.232	±0.001	0.718	±0.009
140	1.55	±0.002	1.104	±0.001	0.714	±0.009

0	1.41	±0.002	0.997	±0.001	0.705	±0.010
200	1.22	±0.001	0.833	±0.001	0.683	±0.010
280	0.99	±0.001	0.625	±0.001	0.630	±0.011

1.3. Graph η vs. R_L

Plot η vs. R_L in Excel with error bars



1.4. Uncertainty on P_{in}, P_{in} and η

Show how you calculate u(P_{in}), u(P_{out}), u(η)

$P_{in} = V_p * I_p$

U(P_{in}) = sqrt ((d(Vp * Ip)/d(Vp) *U(Vp))^2 + (d(Vp * Ip)/d(Ip) *U(Ip))^2)

= sqrt ((Ip*U(Vp))^2 + (Vp * U(Ip))^2)

= sqrt ((0.01*0.6877)^2+(0.0001*6.97)^2)

= ±0.0069 watts

U(P_{in}) = sqrt ((d(Vs * Is)/d(Vs) *U(Vs))^2 + (d(Vs * Is)/d(Is) *U(Is))^2)

= sqrt ((Is*U(Vs))^2 + (Vs * U(Is))^2)

= sqrt ((0.01*0.3292)^2+(0.0001*2.15)^2)

= ±0.0033 watts

U(η) = sqrt ((d(Pout/Pin)/d(Pout) * U(Pout))^2 + (d (Pout/Pin)/d(Pin) * U(Pin))^2)

= sqrt ((U(Pout)/Pin)^2 + (-Pout * Pin^-2 *U(Pin))^2)

= sqrt (0.0033/4.79)^2 + (-0.7078 * 4.79^-2 * 0.0069)^2)

= ±0.0026

1.5. Maximum efficiency

Find the load resistance for which efficiency is maximum

By observing the table and the graph, we see that maximum efficiency was at when the load resistance was **80 Ω** where the efficiency was **72.5%**

2. Discussion

The experiment was successful and the results whereas it was expected. Firstly, we increase the load resistance and note the efficiency which kept on increasing reaching its maximum at 72.5% efficiency while load was 80 Ω. After that efficiency start decreasing with the increase in load resistance.

Possible sources of error could be human error while building up the connections that is machine errors and inaccuracy while noting the values.

3. References