

**ELEC ENG 3PI4**  
**Laboratory 3**  
***Synchronous Generators***

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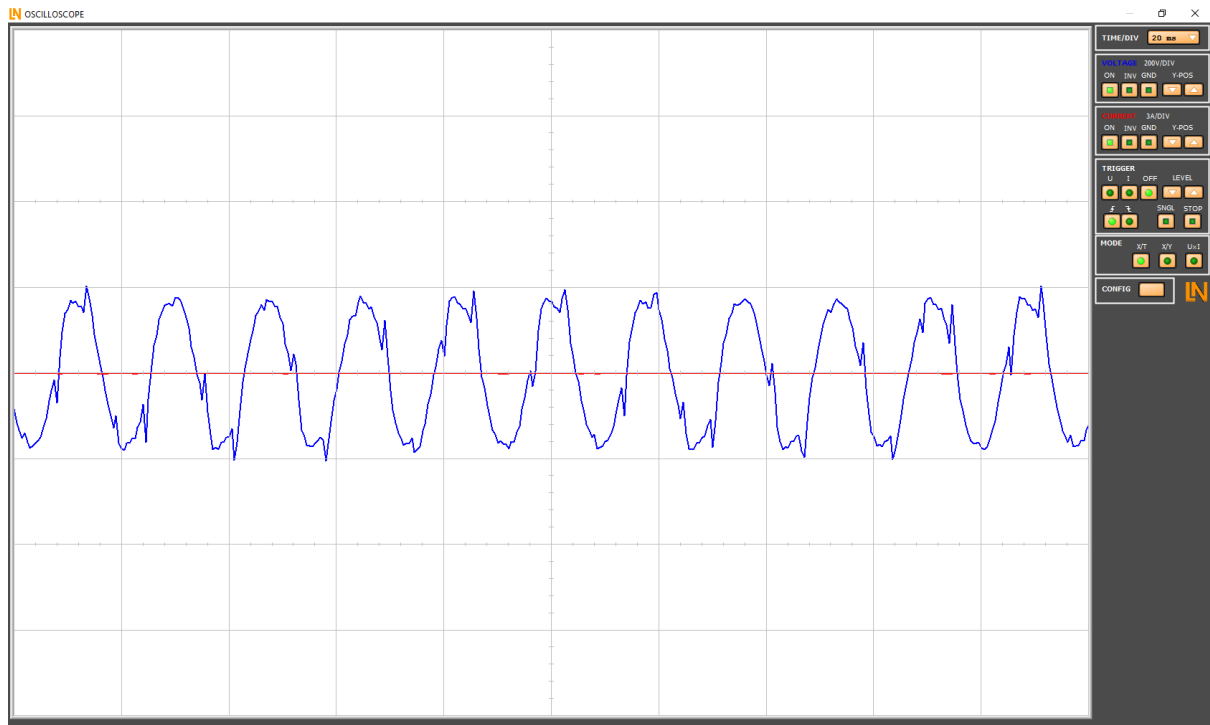
## Part A:

$N = 1700 \text{ RPM}$

$I_F = 4.00 \text{ A}$

$V_{\text{PHASE}} = 128.2 \text{ V}_{\text{rms}}$

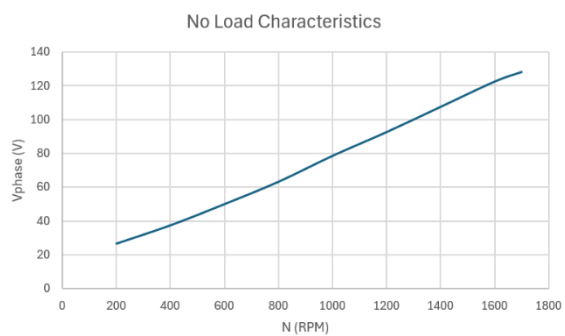
Induced Voltage Waveform:



$I_F = 4.00 \text{ A}$

N (rpm)	200	400	600	800	1000	1200	1400	1600	1700
$V_{\text{PHASE}} \text{ (V)}$	26.9	37.7	50.2	63.4	78.7	92.7	107.6	122.5	128.2

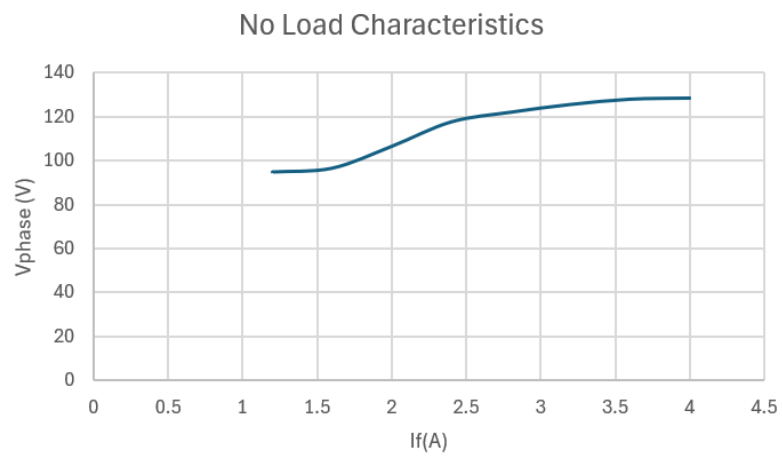
No-load Characteristics of Generator - Waveform:



$N = 1700$

$I_F$ (A)	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
$V_{PHASE}$ (V)	94.7	96.4	106.3	117.4	121.8	125.3	127.7	128.2

No-load Characteristics of Generator - Waveform:



## Part B:

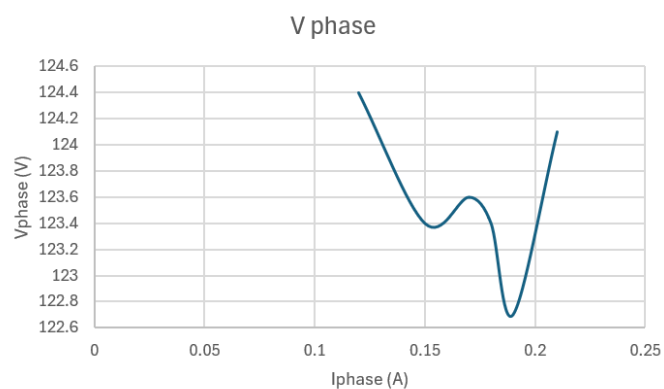
$N = 1700 \text{ RPM}$

$I_F = 4.00 \text{ A}$

$P_{MECH} = \tau * 2\pi * (N/60)$

<b>R (<math>\Omega</math>)</b>	2k	1.5k	1.3k	1.2k	1.1k	1k
<b>I<sub>PHASE</sub> (A)</b>	0.12 A	0.15 A	0.17 A	0.18 A	0.19 A	0.21 A
<b>V<sub>PHASE</sub> (V)</b>	124.4 V	123.4 V	123.6 V	123.4 V	122.7 V	124.1 V
<b><math>\tau</math> (Nm)</b>	0.56 nM	0.64 nM	0.67 nM	0.70 nM	0.72 nM	0.77 Nm
<b>P<sub>ELEC,out</sub> (W)</b>	3*13 = 39 W	3*18 = 54 W	3*19 = 57 W	3*21 = 63 W	3*23 = 69 W	3*24 = 72 W
<b>P<sub>MECH,out</sub> (W)</b>	99.62 W	113.9 W	119.27 W	124.61 W	127.5 W	137.02 W
<b><math>\eta</math> (%)</b>	39%	47%	48%	50.5%	54%	52.5%

No-load Characteristics of Generator - Waveform:



**Question: From the experimental data, could you estimate parameters and equations of this synchronous generator? ( $E_A$ ,  $X_S$ )**

From part A we can estimate the value of  $E_A$  since there is no load

For  $X_S$  we can estimate it from the equation below...

$$X_S = \frac{\sqrt{E_A^2 - V_{PH}^2}}{|I_S|} = \frac{\sqrt{129^2 - 124^2}}{0.12} = 296$$

We can use the data from part A and part B to calculate the above. We can obtain  $I_S$  from part

B, and  $V_{ph} = V_{phase}$