

	A	B	C	D	E	F	G	H	I	J	K	L	M	N																																			
1	<b>Turbine Generator Voltage Analysis</b>																																																
2																																																	
3	Student <u>SAMPLE DATA</u>																																																
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5	Turbine generator variables											Nominal																																					
6	N - Number of loops of wire = coil1+ coil2+coil3 + coil4											800																																					
7	A - Average area enclosed by coil loops (m <sup>2</sup> )											0.001																																					
8	P - Number of Magnetic poles -- 4magnets = 4-poles)											4																																					
9	B - Average Magnetic pole strength of all magnets(Tesla)											0.11																																					
10	Z - Rotational velocity of magnets - revolutions per second (rps)											below																																					
11	F - Frequency of Voltage (Hz) generated by the turbine											below																																					
12	$V_{rms} = 0.707 * N * A * P * B * Z$																																																
13																																																	
14	Prototype Wind Turbine Drill Press Data -No Load																																																
15	Target Values			Measured (Actual)			Calculate																																										
16	RPM rev/min	F (Hz) 4-Pole	Z (rps) rev/sec	RPM rev/min	F (Hz) 4-Pole	V <sub>rms</sub> -MES (volts)	Z (rps) rev/sec	V <sub>rms</sub> -CAL (volts)																																									
17	120	4.00	2.00	117	3.90	0.44	1.95	0.49																																									
18	180	6.00	3.00	183	6.10	0.70	3.05	0.76																																									
19	240	8.00	4.00	236	7.85	0.90	3.93	0.98																																									
20	300	10.00	5.00	297	9.90	1.10	4.95	1.23																																									
21	360	12.00	6.00	363	12.10	1.40	6.05	1.51																																									
22	420	14.00	7.00	417	13.90	1.65	6.95	1.73																																									
23	480	16.00	8.00	476	15.85	1.88	7.93	1.97																																									
24	540	18.00	9.00	540	18.00	2.20	9.00	2.24																																									
25	600	20.00	10.00	603	20.10	2.40	10.05	2.50																																									
											<b>Procedure for Prototype Turbine</b>																																						
											1 Enter the turbine variables in the table																																						
											2 Vary the drill speed (RPM) from low to high																																						
											3 Record actual frequency and voltage																																						
											4 Calculate magnet rotational velocity using the actual values of F ;Z = F/2 for a 4-pole generator																																						
											5 Calculate V <sub>rms</sub> using the table data and the calculated Z																																						
											6 Using a scatter plot graph V <sub>rms</sub> -CAL and V <sub>rms</sub> -MES vs. RPM																																						
											7 Substitute the measured values of coil area "A" that produces the best fit between measured and calculated																																						
											8 Which value of area is the best fit?																																						
											9 Set the drill press for 480 RPM and measure V <sub>L</sub> for various R <sub>L</sub>																																						
											10 Calculate V <sub>L</sub> assuming E <sub>g</sub> = V <sub>L</sub> for R <sub>L</sub> =10000																																						
											$V_L = E_g (R_L / (R_g + R_L))$																																						
											R <sub>g</sub> = <input type="text" value="13"/>																																						
											<table border="1"> <thead> <tr> <th>RPM rev/min</th> <th>F (Hz) 4-Pole</th> <th>Load R<sub>L</sub> (ohms)</th> <th>Measured Load Volts V<sub>L</sub></th> <th>Calculated Load Volts V<sub>L</sub></th> </tr> </thead> <tbody> <tr> <td>480</td> <td>16.00</td> <td>10000</td> <td>1.90</td> <td>1.97</td> </tr> <tr> <td>480</td> <td>16.00</td> <td>27</td> <td>1.30</td> <td>1.33</td> </tr> <tr> <td>480</td> <td>16.00</td> <td>15</td> <td>1.00</td> <td>1.06</td> </tr> <tr> <td>480</td> <td>16.00</td> <td>10</td> <td>0.80</td> <td>0.86</td> </tr> <tr> <td>480</td> <td>16.00</td> <td>5</td> <td>0.50</td> <td>0.55</td> </tr> <tr> <td>480</td> <td>16.00</td> <td>1</td> <td>0.12</td> <td>0.14</td> </tr> </tbody> </table>				RPM rev/min	F (Hz) 4-Pole	Load R <sub>L</sub> (ohms)	Measured Load Volts V <sub>L</sub>	Calculated Load Volts V <sub>L</sub>	480	16.00	10000	1.90	1.97	480	16.00	27	1.30	1.33	480	16.00	15	1.00	1.06	480	16.00	10	0.80	0.86	480	16.00	5	0.50	0.55	480	16.00	1	0.12	0.14
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