Lab 2 – Results: Circuit Theorems

*ECE209: Fundamentals of Electrical Engineering*

|  |  |  |
| --- | --- | --- |
| Name | Student ID | CCID |
|  |  |  |
|  |  |  |

# 2.1 Delta-Wye Transformations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Wye** | | | | | | |
|  | **R1** *(Ω)* | **R2** *(Ω)* | **R3** *(Ω)* | **u-v** *(Ω)* | **v-w** *(Ω)* | **w-u** *(Ω)* |
| Measured |  |  |  |  |  |  |
| Calculated |  |  |  |  |  |  |
| **Delta** | | | | | | |
|  | **Ra** *(Ω)* | **Rb** *(Ω)* | **Rc** *(Ω)* | **x-y** *(Ω)* | **y-z** *(Ω)* | **z-x** *(Ω)* |
| Measured |  |  |  |  |  |  |
| Calculated |  |  |  |  |  |  |

# 2.2 The Test Circuit

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **R\_load** | **Vb** | **Va** | **V\_R1** | **V\_R2** | **V\_load** | **Ib** | **Ia** | **I\_load** |
| *(Ω)* | *(V)* | *(V)* | *(V)* | *(V)* | *(V)* | *(mA)* | *(mA)* | *(mA)* |
| 100 |  |  |  |  |  |  |  |  |
| 220 |  |  |  |  |  |  |  |  |
| 470 |  |  |  |  |  |  |  |  |
| 1000 |  |  |  |  |  |  |  |  |
| *2200* |  |  |  |  |  |  |  |  |

# 2.3 Superposition

## 2.3.1 Vb Acting Alone

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **R\_load** | **Vb** | **Va** | **V\_R1** | **V\_R2** | **V\_load** | **Ib** | **Ia** | **I\_load** |
| *(Ω)* | *(V)* | *(V)* | *(V)* | *(V)* | *(V)* | *(mA)* | *(mA)* | *(mA)* |
| 100 |  |  |  |  |  |  |  |  |
| 220 |  |  |  |  |  |  |  |  |
| 470 |  |  |  |  |  |  |  |  |
| 1000 |  |  |  |  |  |  |  |  |
| *2200* |  |  |  |  |  |  |  |  |

## 2.3.2 Va Acting Alone

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **R\_load** | **Vb** | **Va** | **V\_R1** | **V\_R2** | **V\_load** | **Ib** | **Ia** | **I\_load** |
| *(Ω)* | *(V)* | *(V)* | *(V)* | *(V)* | *(V)* | *(mA)* | *(mA)* | *(mA)* |
| 100 |  |  |  |  |  |  |  |  |
| 220 |  |  |  |  |  |  |  |  |
| 470 |  |  |  |  |  |  |  |  |
| 1000 |  |  |  |  |  |  |  |  |
| *2200* |  |  |  |  |  |  |  |  |

## Superposition (Vb Acting Alone + Va Acting Alone)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **R\_load** | **Vb** | **Va** | **V\_R1** | **V\_R2** | **V\_load** | **Ib** | **Ia** | **I\_load** |
| *(Ω)* | *(V)* | *(V)* | *(V)* | *(V)* | *(V)* | *(mA)* | *(mA)* | *(mA)* |
| 100 |  |  |  |  |  |  |  |  |
| 220 |  |  |  |  |  |  |  |  |
| 470 |  |  |  |  |  |  |  |  |
| 1000 |  |  |  |  |  |  |  |  |
| *2200* |  |  |  |  |  |  |  |  |

# 2.4 Thevenin/Norton

## 2.4.1 Equivalent Parameters

|  |  |  |
| --- | --- | --- |
| **V\_th** | *(V)* |  |
| **I\_norton** | *(mA)* |  |
| **R\_th / R\_norton** | *(Ω)* |  |

## 2.4.2 Thevenin Circuit

|  |  |  |
| --- | --- | --- |
| **V\_th (measured)** | *(V)* |  |
| **R\_th (measured)** | *(Ω)* |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **R\_load** | **V\_load** | **I\_load** | **P\_source** | **P\_load** | **η** |
| *(Ω)* | *(V)* | *(mA)* | *(mW)* | *(mW)* | *(%)* |
| 100 |  |  |  |  |  |
| 220 |  |  |  |  |  |
| 470 |  |  |  |  |  |
| 1000 |  |  |  |  |  |
| *2200* |  |  |  |  |  |

## 2.4.3 Norton Circuit

|  |  |  |
| --- | --- | --- |
| **I\_norton (measured)** | *(mA)* |  |
| **R\_norton (measured)** | *(Ω)* |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **R\_load** | **V\_load** | **I\_load** | **P\_source** | **P\_load** | **η** |
| *(Ω)* | *(V)* | *(mA)* | *(mW)* | *(mW)* | *(%)* |
| 100 |  |  |  |  |  |
| 220 |  |  |  |  |  |
| 470 |  |  |  |  |  |
| 1000 |  |  |  |  |  |
| *2200* |  |  |  |  |  |

# Load I-V Characteristic Plot

The following pages have been left for you to include the plots that you are required to create as part of your post-lab.

To create your plots you can use whichever software you would like (Excel, Matlab, etc), export your plot as an image and import it into your Lab 2 - Results sheet in the appropriate place.

Your plots should include:

* A Plot title
* Label your axes and show what unit of measure is used.
* Include a marking for your data-points.
* Include a line between your data-points in the same series.
* Include a legend.
* Make sure your scales are appropriate and visible.

< Insert your plot here >

For each of these 3 circuits: The Test Circuit, Thevenin Circuit and Norton Circuit plot the load current vs. load voltage on the same plot.

# Thevenin Circuit Plot

< Insert your plot here >

For your Thevenin Circuit results:

Plot the load power vs. load resistance as one series and the circuit efficiency vs. load resistance (R2) as a second series using a secondary y-axis scale.

# Norton Circuit Plot

< Insert your plot here >

For your Norton Circuit results:

Plot the load power vs. load resistance as one series and the circuit efficiency vs. load resistance (R2) as a second series using a secondary y-axis scale.