Title: **More Loaded Voltage Dividers** Worksheet: 16

Course: Electrical Applications Unit: Electrical Theory CLO: 3

Name ANSWER KEY Grade 78pts Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objectives**

1. Student shall design a multi-loaded voltage divider based on given criteria.
2. Student shall recognize the function of a multi-load, loaded voltage divider and how it is useful in control systems.
3. Student shall distinguish the how having multiple loads affects a loaded voltage divider.

**Assessment**

Students shall demonstrate a comprehension of the objectives listed above by scoring a minimum of 75% on this Worksheet. Grading shall be based on an answer key.

**Theory**

Loaded voltage divider is a series circuit that contains at least two resistors and has a load of a specific voltage attached at the junction of the two resistors (see schematic below). In this circuit, the source voltage is divided in two, with the ratio of division being determined by the value of the resistors. The second resistor is termed the bleeder resistor and is therefore denoted RB. When designing a loaded voltage divider, the current passing through the bleeder resistor is 10% of the total load current. The R1 resistor is often referred to as the “drop” resistor since it drops the supply voltage to the required load voltage. For the circuit below, the formulas for determining the drop resistor is as follows;

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

**Circuit**



Where;

**Instructions**

Determine the resistor sizes per the formulas and example on the previous page. Complete the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| R1 | 500mW | 100mA | 50Ω | 5V |
| R2 | 300mW | 60mA | 83.333Ω | 5V |
| RB | 150mW | 10mA | 1.5kΩ | 15V |
| RL1 | 750mW | 50mA | 300Ω | 15V |
| RL2 | 800mW | 40mA | 500Ω | 20V |
| Total | 2.5W | 100mA | 250Ω | 25V |

**Circuit**



Where;

**Instructions**

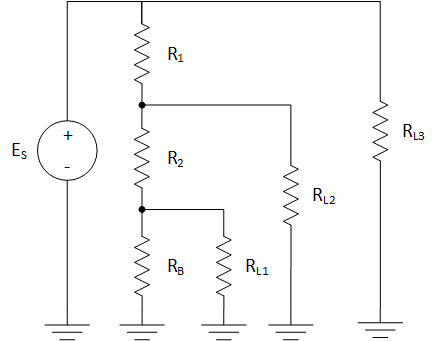
Determine the resistor sizes per the formulas and example on the previous page. Complete the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| R1 | 1.22W | 101.633mA | 118.072Ω | 12V |
| R2 | 361.903mW | 60.317mA | 99.474Ω | 6V |
| RB | 132.123mW | 10.163mA | 1.279kΩ | 13V |
| RL1 | 652mW | 50.154mA | 259.202Ω | 13V |
| RL2 | 785mW | 41.316mA | 459.873Ω | 19V |
| Total | 3.151W | 101.633mA | 305.019Ω | 31V |

**Formulas**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |

**Circuit**



Where;

**Instructions**

Determine the resistor sizes for the circuit above per the above formulas and complete the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| R1 | 2.044W | 85.185mA | 281.740Ω | 24V |
| R2 | 542.22mW | 45.185mA | 265.575Ω | 12V |
| RB | 102.222mW | 8.519mA | 1.409kΩ | 12V |
| RL1 | 440mW | 36.667mA | 327.272Ω | 12V |
| RL2 | 960mW | 40mA | 600Ω | 24V |
| RL3 | 1W | 20.833mA | 2.304kΩ | 48V |
| Total | 5.089W | 106.019mA | 424.919Ω | 48V |

**Evaluation**

1. Would adding a load that does not require a voltage drop (i.e. like RL3 above) cause the design of the voltage drop resistors to change? Why or why not. (2pts)

*No. Adding a load across the entire voltage source will not affect the current through the voltage divider, just the total current.*

This page intentionally almost blank