Title: **Loaded Voltage Dividers** Worksheet: 15

Course: Electrical Applications Unit: Electrical Theory CLO: 3

Name ANSWER KEY Grade 19pts Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objectives**

1. Student shall design a loaded voltage divider based on given criteria.
2. Student shall recognize the function of a loaded voltage divider and how it is useful in control systems.
3. Student shall distinguish the characteristics of a loaded voltage divider separate from that of a unloaded 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 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 resistor values are as follows;

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

If the source voltage is 15V, but the voltage required at the load is 12V, a loaded voltage divider can be created to supply the required voltage. The load will consume 720mW. To determine the resistor values for our circuit, the above formulas can be utilized.

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

Where;



Where;

IL = 40mA, IB = 4.444mA

**Instructions**

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| R1 | 133.333mW | 44.444mA | 67.5Ω | 3V |
| RL | 880mW | 40mA | 550Ω | 22V |
| RB | 97.778mW | 4.444mA | 4.95kΩ | 22V |
| Total | 1.111W | 44.444mA | 562.5Ω | 25V |

Change the values to those listed below and complete the following table.

Where;

IL = 31.875mA, IB = 3.542mA

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| R1 | 177.083mW | 35.417mA | 141.176Ω | 5V |
| RL | 1.275W | 31.875mA | 1.255kΩ | 40V |
| RB | 141.667mW | 3.542mA | 11.294kΩ | 40V |
| Total | 1.594W | 35.417mA | 1.271kΩ | 45V |

1. What is the main difference that you see between a voltage divider and a loaded voltage divider? *Voltage divider only produces a reference voltage where a loaded voltage divider produces power to a specific load.*
2. Describe the relationship between the resistance value of the drop resistor and the amount of voltage difference there is between the source voltage and the load voltage. *Voltage divider only produces a reference voltage where a loaded voltage divider produces power to a specific load.*
3. In the last calculated voltage divider above, what would be an appropriate size   
   (wattage wise) to install for the drop resistor? ½W