Title: **AC Voltage** Lab: 22

Course: Electrical Applications Unit: Electrical Lab CLO: 2, 3, 4

Name ANSWER KEY Grade 160pts Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objectives**

1. Student shall calculate alternating current voltage quantities using the characteristics of sinusoidal waveform.
2. Student shall construct an AC series circuit, take voltage readings and analyze the results.

**Assessment**

Students shall demonstrate a comprehension of the objectives listed above by scoring a minimum of 75% on this Lab. Grading shall be based on instructor evaluation.

**Materials**

|  |  |
| --- | --- |
| Student Provided Materials | Department Provided |
| Proto-Board | DC Power Supply |
| Multimeter | AC Generator |
| Resistor Kit | Oscilloscope |
| Calculator |  |

**Theory**

Alternating current (AC) is an electric current which periodically reverses direction. This power source is a binary differentiation to direct current (DC) which flows continuously only in one direction. Alternating current is the form in which electric power is delivered to a residential outlet most commonly at 120V.

The usual waveform of alternating current in most electric power systems is a *sine wave*. The sine function is commonly used to model periodic phenomena such as sound, sunlight, day length, and average temperature variations throughout the year.

**Graphic**



EP – From x axis to maximum (peak) amplitude.

EPP – From maximum (peak) amplitude to minimum (-peak) amplitude

ERMS – Root, Mean, Square of waveform

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

**Circuit**



Where

**Instructions**

Calculations

Compute the following values based on the formula from the previous page and the information given above.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P | I | R | ERMS | EP | EPP |
| R1 | 1.356mW | 1.556mA | 560Ω | 871.461mV | 1.232V | 2.464V |
| R2 | 2.422mW | 1kΩ | 1.556V | 2.201V | 4.402V |
| R3 | 1.138mW | 470Ω | 731.405mV | 1.034V | 2.068V |
| R4 | 1.356mW | 560Ω | 871.461mV | 1.232V | 2.464V |
| Total | 6.272mW | 2.59kΩ | 4.031V | 5.7V | 11.4V |

Measurements

Construct the circuit shown above. Take measurements and complete the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P | I | R | ERMS | EP | EPP |
| R1 |  |  |  |  |  |  |
| R2 |  |  |  |  |  |  |
| R3 |  |  |  |  |  |  |
| R4 |  |  |  |  |  |  |
| Total |  |  |  |  |  |  |

**Instructions**

Measurements

Replace the signal generator with a DC power supply set to the ERMS voltage measured in the previous step. Complete the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| R1 |  |  |  |  |
| R2 |  |  |  |  |
| R3 |  |  |  |  |
| R4 |  |  |  |  |
| Total |  |  |  |  |

1. Are the answers in this table comparable to those from when the signal generator was supplying the circuit? Why or why not.

*Yes. Because the RMS value is the DC equivalent of the AC source.*

**Circuit**



Where

**Instructions**

Calculations

Compute the following values based on the formula from the previous page and the information given above.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P | I | R | ERMS | EP | EPP |
| R1 | 13.333mW | 3.333mA | 1.2kΩ | 4V | 5.7V | 11.4V |
| R2 | 5.926mW | 1.481mA | 2.7kΩ | 4V | 5.7V | 11.4V |
| R3 | 8.888mW | 2.222mA | 1.8kΩ | 4V | 5.7V | 11.4V |
| Total | 28.148mW | 7.037mA | 568.421Ω | 4V | 5.7V | 11.4V |

Measurements

Construct the circuit shown above. Take measurements and complete the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P | I | R | ERMS | EP | EPP |
| R1 |  |  |  |  |  |  |
| R2 |  |  |  |  |  |  |
| R3 |  |  |  |  |  |  |
| Total |  |  |  |  |  |  |

**Instructions**

Measurements

Replace the signal generator with a DC power supply set to the ERMS voltage measured in the previous step. Complete the table below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | P | I | R | E |
| R1 |  |  |  |  |
| R2 |  |  |  |  |
| R3 |  |  |  |  |
| Total |  |  |  |  |

1. Are the answers in this table comparable to those from when the signal generator was supplying the circuit? Why or why not.

*Yes. Because the RMS value is the DC equivalent of the AC source.*

Evaluations

1. What would be the effect of increasing the frequency on IT in the series circuit example?
   1. Go Up
   2. Go Down
   3. Stayed the same
2. What would be the effect of IT in the parallel circuit example if a 10V AC source was replaced by a 10V DC source?
3. Go Up
4. Go Down
5. Stayed the same
6. Since an AC signal has the same amount of positive voltage as negative voltage, the total voltage is 0V?
7. True
8. False
9. If you connected two separate power sources, first a 120V DC and next a 120V AC to this circuit, the result would be different voltage drops across this circuit for each source?
10. True
11. False