Title: **Transformers** Lab: 23

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

Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Grade \_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Objectives**

1. Student shall calculate input and output quantities of a transformer using the characteristics of inductance and electromagnetism.
2. Student shall construct an AC 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 |
| Multimeter | Transformers |
| Amp-clamp |  |
| Calculator |  |

**Theory**

A transformer is a device that transfers AC electrical energy from one circuit to another. It does this by means of electromagnetic mutual inductance. Generally, a transformer consists of two coils of wire placed close enough together so the magnetic field around the first coil of wire cuts the windings of the second coil of wire. In this process, energy is transferred from the first coil to the second. The transformer is widely used in electronics. It can step-up or step-down voltage or current, isolate one circuit from another, match impedances and provide safety protection to the equipment user. Transformers do not amplify. The power in its primary is always equal to it power in its secondary for and ideal transformer (100% efficient). In actuality, the power in the secondary is always less than the power in the primary because of the losses in the coils of wire and the transformer’s coil.

**Graphic**

|  |  |  |  |
| --- | --- | --- | --- |
|  | |  | |
| EP – Primary voltage (V) | | ES – Secondary voltage (V) |
| IP – Primary current (A) | | IS – Secondary current (A) |
| NP – Primary turns ratio | | NS – Secondary turns ratio |
| SP – Primary apparent power (VA) | | SS – Secondary apparent power (VA) |

**Instructions**

Use one of the transformers in the set. **DO NOT PLUG IT IN**. Perform the following steps using your multimeter.

1. Check for continuity between the prongs of the AC plug. This will be the primary winding resistance.

Primary-to-Primary Resistance \_\_\_\_\_\_

1. Check for continuity between the terminals or prongs of the output of the transformer. This will be the secondary winding resistance.

Secondary-to-Secondary Resistance \_\_\_\_\_\_

1. Measure from one prong of the plug (primary) to a terminal or spade on the output (secondary)

Resistance \_\_\_\_\_\_

1. Measure from the other prong of the plug (primary) to another terminal or spade on the output (secondary)

Resistance \_\_\_\_\_\_

1. What is the electrical resistance between the primary and the secondary windings?
   1. 0Ω
   2. Between 0Ω and 5Ω
   3. Greater than 5Ω
   4. No continuity

**Instructions**

For each transformer listed below, connect to lighting load bank and measure and complete the tables calculating the unknown quantities.

Transformer A

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | I | R | E | N |
| P |  |  |  |  |  |
| S |  |  |  |  |  |

Efficiency at load \_\_\_\_\_\_

Transformer B

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | I | R | E | N |
| P |  |  |  |  |  |
| S |  |  |  |  |  |

Efficiency at load \_\_\_\_\_\_

Transformer C

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | I | R | E | N |
| P |  |  |  |  |  |
| S |  |  |  |  |  |

Efficiency at load \_\_\_\_\_\_

Transformer D

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | S | I | R | E | N |
| P |  |  |  |  |  |
| S |  |  |  |  |  |

Efficiency at load \_\_\_\_\_\_

Evaluations

1. If the number of primary winding turns are increased on a step-down transformer, the secondary voltage would?
   1. Go Up
   2. Go Down
   3. Stayed the same
2. If the number of secondary winding turns are increased on a step-down transformer, the primary current would?
   1. Go Up
   2. Go Down
   3. Stayed the same
3. There is no practical use for a transformer that has a 1:1 turns ratio?
   1. True
   2. False
4. A buck transformer?
   1. Steps up the voltage
   2. Steps down the voltage
   3. Voltage remains the same
   4. Costs one dollar
5. In a step-up transformer, the voltage is \_\_\_\_\_\_\_\_\_ and the current is \_\_\_\_\_\_\_\_\_.
   1. Increased, Increased
   2. Decreased, Decreased
   3. Increased, Decreased
   4. Decreased, Increased

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