A. Transformer Equivalent Circuit

A1. Transformer Polarity and Turn Ratio:

1. Connect a 1-Φ transformer to a 120V power supply and leave the secondary side open as shown in Fig. 2(a). Record the primary and secondary voltages, \( V_p \) and \( V_s \).
2. Connect the transformer as shown in Fig. 2(b) and measure \( V \).
3. Repeat step 2 above for Fig. 2(c).

A2. Open and Short Circuit Tests:

1. Connect a 1-Φ transformer to a 120V power supply and leave the secondary side open as shown in Fig. 2(a). Record the exciting current and active power delivered to the transformer.
2. Connect the primary side of the transformer to a variable AC power supply which must initially be set to zero volts. Short circuit the secondary side (see figure 2(d)) and slowly increase the variable supply voltage until the secondary current reaches 3 A. Record the voltage, current and active power.

B. Transformer Voltage Regulation and Efficiency

1. Connect the circuit shown in Fig 2(e) with \( V_p = 120V \), \( L = 0.133 \) H, and \( R = 50 \) \( \Omega \).
2. Record the current, active power and voltage at the load side (i.e., secondary side).
3. Repeat the measurements above on the supply side (i.e. primary side)

C. Transformer Excitation Current

1. Refer to first part of Section A2 above, i.e., no-load test. Connect the primary winding to a variable AC voltage source, and leave the secondary winding open. Use a Fluke meter to record the rms value, peak value and waveshape of the excitation current for the following supply voltages: 100 V, 120 V, and 140 V.
D: Autotransformer

1. Use the primary side of the laboratory as an autotransformer (see Fig. 2(f)). Connect the primary side to a voltage source = 120V, and record the secondary side voltage.
2. Now connect a resistive load with $R = 75 \, \Omega$ and record the current, active power and voltage at the load side.
3. Repeat the measurements above on the supply side.

QUESTIONS

I. Transformer Equivalent Circuit

1. Determine the turn ratio and polarity marking from the measurements in Part A, 1 of the experiment.
2. Determine the core resistance $R_c$ and magnetizing reactance $X_m$ of the transformer from the open circuit test.
3. Calculate the equivalent copper resistance and leakage reactance of the transformer (when referred to the primary side) from the short circuit test.

II. Voltage Regulation and Efficiency

4. Determine the transformer voltage regulation and efficiency with the load in figure 2(e) from measured values.

III. Excitation Current

5. Is the rms value of the excitation current equal to its peak value divided by $\sqrt{2}$? Explain.
6. Is the rms value of the excitation current proportional to the rms value of the applied voltage? Explain.

IV. Autotransformer

7. Compute the ratio of the series winding turns and the common winding turns, i.e., $N_{SE}/N_C$. Also compute the portion of the load power that was supplied through direct conduction, and the portion of the load power that was supplied through induction.
8. Compute the autotransformer efficiency and voltage regulation under the specified load.