

# ECE 3600 homework 8B Non-Ideal transformers, tests

c

- A 500V/200V, 30-kVA, 60-Hz transformer is subjected to a SC test. The secondary is short-circuited and the primary voltage is raised until rated current is flowing. This occurs when the applied voltage equals 8.2% of rated winding voltage. The transformer consumes 600 W during the test.

  - Compute the series impedance  $Z_s = R_s + jX_s$  of the transformer.
  - Compute the core flux during the SC test. (Express its magnitude in percent of normal operating flux.)
  - Why is it permissible to assume that all of the 600 W constitute ohmic losses in R, and no part of it is core loss?
- The same 30-kVA transformer is subjected to an OC test. The transformer consumes 500 W and draws 1.8 A.

  - Find  $R_m$  and  $X_m$ .
  - The open-circuit voltage measured on the secondary is 206V. Find the actual turns ratio.
- The same 30-kVA transformer has the following impedance is hooked to the secondary:  $Z_L := (1.3 + 0.2 \cdot j) \cdot \Omega$

  - Find the currents in both windings and the secondary voltage by use of the ideal (IT) model.  $V_p := 500 \cdot V$
  - Same as in part a) but now include the transformer impedances and actual turns ratio in your analysis. Take note of the change in your answers.
  - Find the efficiency.
  - Is the transformer current-overloaded?
- A transformer is rated at 210V / 70V, 420VA.

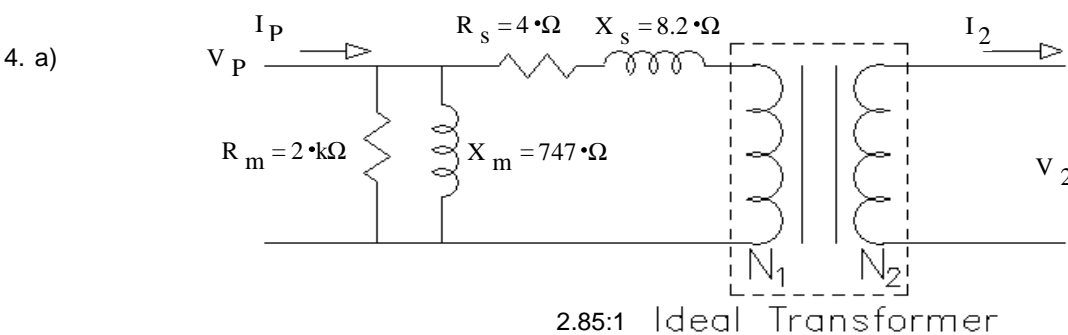
The following values were found by making the standard OC and SC tests.  $R_m := 2 \cdot k\Omega$   $X_m := 747 \cdot \Omega$   
 $R_m$  and  $X_m$  were neglected when finding the other two components.  $N := 2.85$

$R_s := 4 \cdot \Omega$   $X_s := 8.2 \cdot \Omega$

  - Draw the standard non-ideal transformer model and label the parts.
  - What were the measurements that were taken in the standard open-circuit test? (Give me numbers)
  - What were the measurements that were taken in the standard short-circuit test? (Give me numbers)

## Answers

- $0.167 + 0.663j \cdot \Omega$
  - 8.2% of normal rated value.
  - Because the core flux is 8.2% of normal rated value, the core losses (which are approximately proportional to the square of the flux) are negligible.
- $500 \cdot \Omega$  &  $334 \cdot \Omega$
  - 2.427
- 60.8·A    152.1·A    200·V    b) 62.2·A a little more    151·A a little less    198.6·V
  - 96.3·%
  - yes, barely.



- 22.05·W    0.3A    73.68·V    c) 16·W    18.25·V