King Fahd University of Petroleum and Minerals

EE-306 – Electromechanical Devices - Semester 191

Due Date Oct. 16th 2019

Question 1)

A single-phase, 10 kVA, 2200/220V 60 Hz transformer has: R_1= 1 Ω, L_1= 7.96 mH, R_2= 0.1 Ω and L_2= 0.796 mH. A load of 6 kW, 0.8 pf lagging is connected to its secondary side. Using transformer approximated equivalent circuit without excitation branch shown in Figure 1, find:

1- Transformer input current.
2- Input power factor
3- Draw the phasor diagram

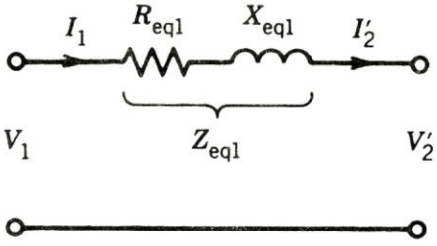

Figure 1: Approximated equivalent circuit

Question 2)

A single-phase, 20 kVA, 2200/220V 60 Hz transformer has equivalent impedance $5 + j25\ \Omega$ referred to its primary side. Find the voltage regulation if the transformer is loaded by:

1- Full load, 0.8 lagging pf.
2- 70% of its full load with 0.8 leading pf.

Question 3)

A 10 kVA, 2300/230 V, single-phase transformer has been tested while keeping the meters are connected at the HV side. The tests data are as follows:

- OCT at rated voltage: 0.45 A and 70 W (Measurements at HV side)
- SCT at rated current: 120 V, 240 W (Measurements at HV side)

1- Determine the approximate equivalent with excitation branch circuit referred to HV side.
2- Determine the transformer efficiency at full load, 0.8 pf lagging

Question 4)

For the transformer of Question 3,

1- Determine the percentage loading of the transformer at which the efficiency is a maximum at a load pf of 0.8
2- Calculate the maximum efficiency

Question 5)

The efficiency of a 400 kVA, 60 Hz single-phase transformer is 98.77% when delivering full load current of 0.8 pf, and 99.13 % while delivering half rated current at unity power factor. Find:

1- core losses
2- full-load copper losses