KING FAHD UNIVERSITY OF PETROLEUM & MINERALS
ELECTRICAL ENGINEERING DEPARTMENT
EE 306 – Term 192
HW # 3: Single Phase Transformers
Due Date: (UT-Classes, March 1st, 2020; MW-Classes, March 2nd, 2020)

Problem # 1:

(a) A 480/240V, 4.8kV A, 60Hz, single-phase transformer is used to supply a 4.8kV A load with a 0.8 lagging power factor, at rated voltage (240V)
(b) If the transformer were ideal, what would be the magnitude of the current on the primary (480V) side?
(c) What is the impedance of the load under the ideal assumption?
(d) Again, if the transformer is ideal, what would the impedance be as viewed from the primary side?

Problem # 2:

A 15-kVA 8000/230-V distribution transformer has an impedance referred to the primary of 80 + *j*300Ω. The components of the excitation branch referred to the primary side are R_C = 350 kΩ and X_M = 70 kΩ.

(a) If the primary voltage is 7967 V and the load impedance is $Z_L = 3.0 + j1.5\ \Omega$, what is the secondary voltage of the transformer? What is the voltage regulation of the transformer?

(b) If the load is disconnected and a capacitor of $-j4.0\ \Omega$ is connected in its place, what is the secondary voltage of the transformer? What is its voltage regulation under these conditions?

Problem # 3:

A 250 kVA, 3600/240 V, single-phase transformer has the following test data:

	Voltage (V)	Current (A)	Power (W)
O/C Test	240	57.85	4985
S/C Test	187	69.45	4823

Find:

(a) The approximate equivalent circuit referred to HV and LV side.
(b) The voltage regulation and efficiency when the load takes 1100 A at 220 V and 0.6 lag pf. (NOTE: this is not rated load).
(c) The voltage regulation and efficiency at rated load conditions and 0.8 lag pf.

Problem # 4:

A 1φ, 25 kVA, 2300=230 V transformer has the following parameters:

$$Z_{eq,H} = 4.0 + j5.0\ \Omega$$
$$R_{c,L} = 450\ \Omega$$
$$X_{m,L} = 300\ \Omega$$

(a) The transformer is connected to a load whose power factor varies. Determine the worst-case voltage regulation for full-load output, and draw the phasor diagram of this case.

(b) Determine efficiency when the transformer delivers full load at rated voltage and 0.85 power factor lagging.

(c) Determine the percentage loading of the transformer at which the efficiency is a maximum and calculate this efficiency if the power factor is 0.85 and load voltage is 230 V.