EE 360	**QUIZ # 3**
Student Name :	Student ID:

A 10-kVA, 450 / 120-V, 60-Hz, transformer gives the following test results:
Open circuit test (HV side open): 120 V, 4.2 A, 80 W
Short circuit test (LV side short): 9.65 V, 22.2 A, 120 W
(a) Derive the approximate equivalent circuit referred to the high-voltage side.
(b) Determine the voltage regulation at full load and 0.8 PF leading.
(c) Determine the efficiency at 50% of full load and 0.8 PF lagging.

O.C

$R_c' = \frac{(120)^2}{80} = 180\ \Omega$, $a = \frac{450}{120} = 3.75$

$R_c = a^2 R_c' = \underline{2530\ \Omega}$

$I_c' = \frac{120}{R_c'} = 0.667\ A$ & $I_m' = \sqrt{I_o^2 - I_c'} = 4.15\ A$

$X_m' = \frac{120}{I_m'} = 28.94\ \Omega$

$X_m = a^2 X_m' = \underline{407\ \Omega}$

S.C

$Z_{e_1} = \frac{9.65}{22.2} = 0.435\ \Omega$

$R_{e_1} = \frac{120}{(22.2)^2} = \underline{0.243\ \Omega}$

$X_{e_1} = \sqrt{Z_{e_1}^2 - R_{e_1}^2} = \underline{0.361\ \Omega}$

$I_{1FL} = \frac{10000}{450} = 22.2\ A$

Voltage Drop $\simeq I_1 (R_{e_1} \cos\phi + X_{e_1} \sin\phi) \simeq 9.2\ V$

$VR = \frac{9.2}{450} * 100 = 2.04\ \%$

$\eta_{FL} = \frac{10000 * 0.8}{10000 * 0.8 + 80 + 120} * 100 = 97.57\%$

at half load

$\eta = \frac{\frac{1}{2} * 10000 * 0.8}{\frac{1}{2} * 10000 * 0.8 + 80 + (\frac{1}{2})^2 * 120} * 100 = 97.34\%$