King Fahd University of Petroleum & Minerals
Electrical Engineering Department
EE205: Electric Circuits II (031)
Quiz 2

Name: KEY ID# Sec. 01

A balanced three-phase distribution **line** has an impedance of 1+*j*5 Ω/Ø. This line is used to supply a three-phase induction motor. This motor output 300 hp, with 96% efficiency and power factor of 0.90 lag. The magnitude of the line voltage at the terminal of the motor is 2080V(1 hp= 746 W)

a) What is the magnitude of the line current drawn from the 2080V outlet?

$P_{out} = 300\ hp * \frac{746\ W}{1\ hp} = 223\,800\ W$

$\eta_{eff} = \frac{P_{out}}{P_{in}} \rightarrow P_{in} = \frac{223\,800}{0.96} = 233\,125\ W$

$\sqrt{3}\, V_L I_L \cos\theta = 233\,125$

$I_L = \frac{233\,125}{\sqrt{3}(2080)(0.9)} = 71.899\ A$

b) Calculate the reactive power supplied to the motor.

$1 = \sin^2\theta_\phi + \cos^2\theta_\phi \Rightarrow \sin\theta_\phi = 0.436$

$Q = \sqrt{3}\, V_L I_L \sin\theta_\phi = \sqrt{3}(2080)(71.899)(0.436)$

$= 112\,936.234\ VAR$

c) What is the total average power loss in the three-phase line?

$P_{loss} = 3 I_L^2 R = 3(71.899)^2(1) = 15\,508.399$ Watts

Good Luck,
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