Per-Unit 1 Due: e

Name _____ ECE 3600 homework 10

1. A 3-phase system operates at $200\ \text{kVA}$ and $10\ \text{kV}$. Using these quantities as base values, find:

   a) The base current and base impedance for the system.

   Use these bases below:

   b) Express the following as a per-unit values

   $V_L := 8 \cdot kV$

   $I_L := 12 \cdot A$

   $\mathbf{I_L} := (5 + 2j) \cdot A$

   $P := 40 \cdot kW$

   $Q_{1\phi} := 20 \cdot kVAR$

   $\mathbf{Z} := 1.2 \cdot k\Omega \cdot e^{-j \cdot 10 \cdot deg}$

   c) The line voltage represented by $V_{pu} := 0.98 \cdot pu$

   d) The line-to-neutral voltage represented by $V_{pu} := 1.04 \cdot pu$

   e) The real power represented by $P_{pu} := 0.3 \cdot pu$

   f) The single-phase power represented by $P_{pu} := 0.3 \cdot pu$

   g) The single-phase reactive power represented by $\mathbf{S_{pu}} := 0.4 \cdot e^{j \cdot 14 \cdot deg} \cdot pu$

   h) The line current represented by $\mathbf{I_{pu}} := (0.5 + 0.2j) \cdot pu$

   i) The impedance represented by $\mathbf{Z_{pu}} := 2.8 \cdot pu \cdot e^{j \cdot 24 \cdot deg}$

ECE 3600 homework 10 p2

2. If $26.1\ \Omega$ is the impedance base and $124\ \text{A}$ is the current base for a 3-phase system, find the power base and voltage base.

3. A 3-phase transmission line supplies a reactive load at a lagging power factor. The load draws $0.5\ \text{pu}$ current at $1.0\ \text{pu}$ voltage while using $0.4\ \text{pu}$ real power. If the base voltage is $20\ \text{kV}$ and the base current is $16\ \text{A}$, calculate the power factor and the values of the resistance and reactance of the load. Give both the pu and Ω.

Answers 1. a) $11.6 \cdot \text{A}$ $500 \cdot \Omega$
b) $0.8 \cdot \text{pu}$ $1.039 \cdot \text{pu}$ $(0.433 + 0.173 \cdot \text{j}) \cdot \text{pu}$ $0.2 \cdot \text{pu}$ $0.3 \cdot \text{pu}$ $(2.364 - 0.417 \cdot \text{j}) \cdot \text{pu}$ c) $9.8 \cdot \text{kV}$ d) $6 \cdot \text{kV}$
e) $60 \cdot \text{kW}$ f) $20 \cdot \text{kW}$ g) $6.45 \cdot \text{kVAR}$ h) $(5.77 + 2.31\text{j}) \cdot \text{A}$ i) $(1.28 + 0.57\text{j}) \cdot \text{k}\Omega$ 2. $1.2 \cdot \text{MVA}$ $5.61 \cdot \text{kV}$
3. $80 \cdot \%$ If R & X are in parallel $2.5 \cdot \text{pu}$ $1.804 \cdot \text{k}\Omega$ $3.333 \cdot \text{pu}$ $2.406 \cdot \text{k}\Omega$
If R & X are in series $1.6 \cdot \text{pu}$ $1.155 \cdot \text{k}\Omega$ $1.2 \cdot \text{pu}$ $0.866 \cdot \text{k}\Omega$

ECE 3600 homework 10 p2