

Per-Unit 1

e

Name _____ ECE 3600 homework 10 Due: Mon, 2/10/25

1. A 3-phase system operates at 200 kVA and 10 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

$$V_L := 8 \cdot \text{kV}$$

$$I_L := 12 \cdot \text{A}$$

$$\mathbf{I}_L := (5 + 2j) \cdot \text{A}$$

$$P := 40 \cdot \text{kW}$$

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

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

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

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

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

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

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

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

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

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2. If 26.1Ω is the impedance base and 124 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 pu current at 1.0 pu voltage while using 0.4 pu real power. If the base voltage is 20 kV and the base current is 16 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 A $500 \cdot \Omega$
 b) $0.8 \cdot \text{pu}$ $1.039 \cdot \text{pu}$ $(0.433 + 0.173 \cdot j) \cdot \text{pu}$ $0.2 \cdot \text{pu}$ $0.3 \cdot \text{pu}$ $(2.364 - 0.417 \cdot j) \cdot \text{pu}$ 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) $(5.77 + 2.31j) \cdot \text{A}$ i) $(1.28 + 0.57j) \cdot \text{k}\Omega$ 2. $1.2 \cdot \text{MVA}$ $5.61 \cdot \text{kV}$
 3. 80% 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**