EE 456: Power System Analysis I

Homework 1:

Due September 9, 2015 for on-site students, and September 11, 2015 for distance learning students

Distance learning students: please email your scanned homework to TA (Yunshan Xu, yunshanx@iastate.edu)

1. The electric current and voltage at one terminal of a single phase transmission line are:

$$\tilde{I} = 141\cos(\omega t - 10^{\circ}), A$$
$$\tilde{V} = 390\cos(\omega t + 5^{\circ}), V$$

Compute the rms values of the electric current and voltage, the complex power, and the real and reactive power flowing into the line.

2. Two single-phase ideal voltage sources are connected by a line of impedance of $0.7 + j2.4\Omega$ as shown in Fig. 1. $V_1 = 500\angle 16.26°$ V and $V_2 = 585\angle 0°$ V. Plot $\widetilde{V_1}, \widetilde{V_2}$ and $\widetilde{I_{12}}$ in a phasor diagram. Also, find the real and reactive power loss in the line.

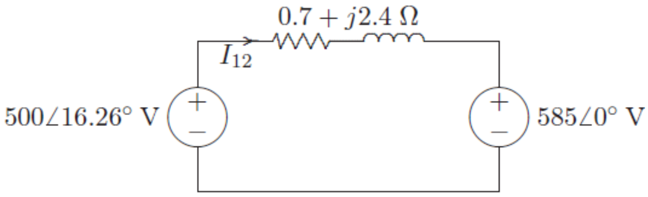

Fig. 1

3. A single-phase inductive load consisting of R and X in series feeding from a 2400-V rms single-phase supply absorbs 288 kW at a lagging power factor of 0.8. Determine R and X.

4. The system shown in Fig. 2 is balanced. Assume that:

$$Z = 10\angle -15^{\circ} \quad \Omega$$
$$V_{ca} = 208\angle -120^{\circ} \quad V$$

Find $V_{ab}, V_{bc}, V_{an}, V_{bn}, V_{cn}, I_a, I_b$ and I_c

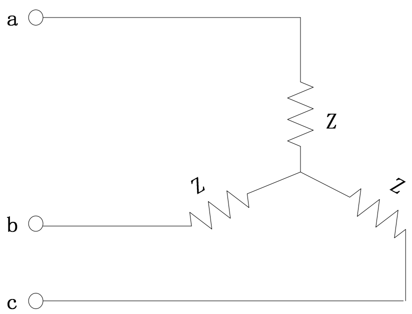

Fig. 2

5. A balanced delta-connected load consisting of a pure resistances of $18\,\Omega$ per phase is in parallel with a purely resistive balanced Y-connected load of 12Ω per phase as shown in Fig. 3. The combination is connected to a three-phase balanced supply of 346.41-V rms (line-to-line) via a three-phase line having an inductive reactance of $j3\Omega$ per phase. Taking the phase voltage V_{an} as reference, determine

(a) The magnitudes of current, real power, and reactive power drawn from the supply.

(b) The line-to-neutral and the line-to-line voltage magnitudes of phase a at the combined load terminals.

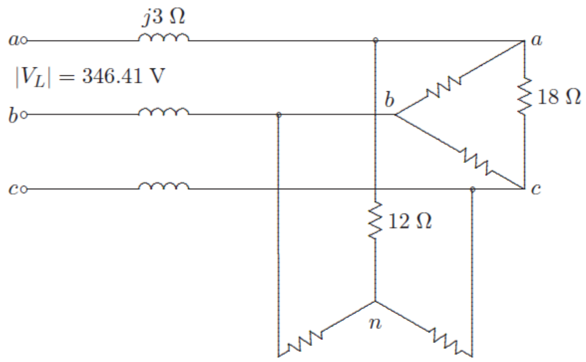

Fig. 3