

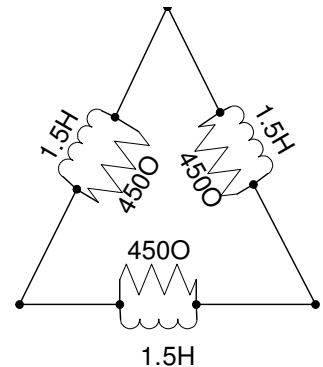
ECE204—AC Circuits

Review for Test 3 w/ answers

1. A delta-connected three-phase load consists of three $37.5 \Omega/\text{ph}$ resistors in parallel with three $132.6 \text{ mH}/\text{ph}$ inductors. It is connected to a 7.2 kV (line-to-line) supply via a distribution feeder that has an impedance of $0.4 + j0.8 \Omega/\text{ph}$.
- Draw the single-phase equivalent circuit.
 - Determine the voltage regulation when the supply voltage is 7.2 kV .
 - Determine the efficiency of transmission for the conditions in part (b).

ANS: $VR=8.1\%$, $\eta=95.2\%$

2. Three loads A, B & C are supplied at 12.47 kV , 60 Hz , from an ideal three-phase source. Load A is 1.8 MVA at 0.75 lag, load B is 585 kW at 0.9 lead, and load C is three delta-connected $450 \Omega/\text{ph}$ resistors in parallel with three $1.5 \text{ H}/\text{ph}$ inductors (shown right). Determine:



- Complex power drawn from the source.
- The value of capacitance ($\mu\text{F}/\text{ph}$) that has to be placed in parallel with the loads to make the overall power factor 0.925 lag.

ANS: $S_s=990.6+j577.4\text{kVA}/\text{phase}$; $C = 8.72\mu\text{F}/\text{phase}$

3. A three-phase load is fed from a 60 Hz supply via three parallel feeders each with impedance $0.1 + j0.25 \Omega/\text{phase}$. The load is 9 MVA , 0.864 pf **lag**. The voltage at the load is 4.16 kV . Determine:

- Magnitude of the supply voltage (V_s)
- Percent Voltage Regulation (VR)
- Real power drawn from the supply
- Real power lost in the feeder
- Efficiency of transmission

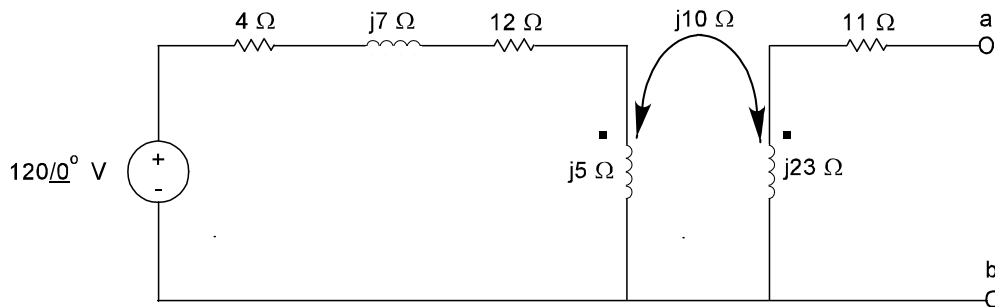
ANS: $|V_s| = 4.31\text{kV}$ (line-line); $VR = 3.7\%$; $\eta=98\%$

4. A factory is supplied at 34.5 kV from an ideal 3ϕ , 60 Hz supply. It draws a continuous load of 30 MW with a pf of 0.6 lag. Determine:

- The capacitance ($\mu\text{F}/\text{phase}$) of a Y-connected bank that will improve the pf to 0.95 lag.
- The capacitance ($\mu\text{F}/\text{phase}$) if a Δ -connected bank were used.
- The annual saving in demand charge, if the monthly demand charge is $\$12.00/\text{kVA}$.
- The payback time in months if capacitors cost $\$90/\text{kVAR}$ to purchase and install and interest is ignored.

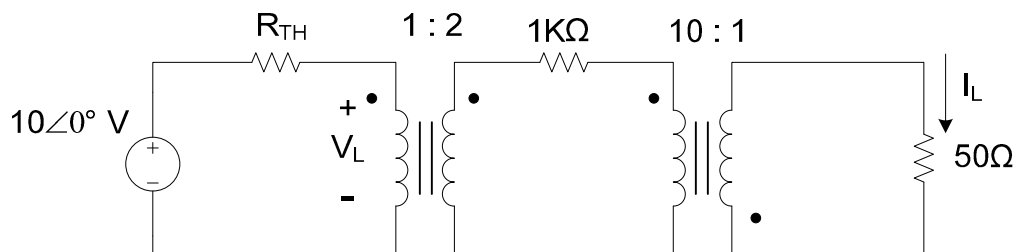
ANS: $C_Y = 67.2\mu\text{F}$; $C_\Delta = 22.4\mu\text{F}$, Savings $\$2.65$ Million; payback = 53 weeks

5. For the following circuit, determine:
- the Thevenin equivalent (V_{Th} and Z_{Th}) at a-b
 - the coupling factor (k), if the source frequency is 1 kHz



ANS: $V_{Th} = 60\angle 53.1^\circ \text{ V}$; $Z_{Th} = 25\angle 53.1^\circ \Omega = 15 + j20\Omega$, $k = 0.9325$.

6. For the following circuit,
- Find R_{Th} such that $V_L = 5\angle 0^\circ \text{ V}$
 - use R_{Th} from **part a** and $V_L = 5\angle 0^\circ \text{ V}$ to find the current I_L in phasor form.



ANS: $R_{Th} = 1500\Omega$, $I_L = -50/3 \text{ mA}$.