

ECE204 AC Circuits

Midterm Exam 3

11/04/2010

NAME: _____

- **NO PARTIAL CREDIT WILL BE GIVEN** without a full explanation of the procedure followed to arrive at your solution. Put a box around your solution. **DON'T FORGET UNITS AND CONDITIONS ON VALIDITY.**
- One 8½ x 11 inch formula sheets (both sides) may be used. Laptops may not be used. Cellphones must be turned-off.
- Time allowed : 50 min.
- You may use both sides of the paper for your answer. Please use the back of the previous page.
- Present all **phasor** quantities in **polar** form with the angle in degrees and state magnitudes to 3 significant figures.

Question #	Possible Points	Awarded Points
1	25	
2	25	
3	25	
4	25	
Total	100	

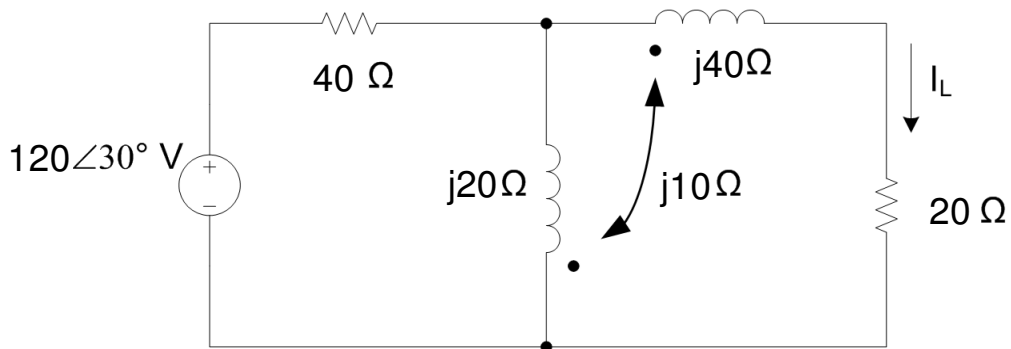
1. A three-phase Y—connected load consisting of 16 MW, 0.84 pf **lag** is fed from a 60 Hz supply via a feeder with impedance $0.2 + j0.6 \Omega/\text{phase}$. The line voltage at the load is 13.8 kV. Determine:
- a) Percent Voltage Regulation (VR)
 - b) Complex power drawn from the supply
 - c) Efficiency of transmission
 - d) The impedance of the load, in Ω/phase , if it is a resistor and inductor in series
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- a) 5.01%
 - b) $\mathbf{S}_{source} = 20 \angle 35 \text{ MVA}$
 - c) 97.67%
 - d) $8.394 + j5.43 \Omega/\text{ph}$

2. Three loads 1, 2 & 3 are supplied at 4.16 kV, 60 Hz, from an ideal three-phase source. Load 1 is 135 kW at 0.75 lag, load 2 is 65 kVA at 0.9 lead, and load 3 is three delta-connected 300 Ω /ph resistors in series with three 647 mH/ph inductors. Determine:
- The complex power drawn from the source
 - The value of Y—connected capacitance ($\mu\text{F}/\text{ph}$) that has to be placed in parallel with the loads to make the overall power factor 0.95 lag.

a) $\mathbf{S}_{load} = 345.5 \angle 30 \text{ kVA}$

b) $C = 11.89 \mu\text{F}/\text{ph}$

3.
a) For the following circuit, find the current I_L in phasor form.



- b) Suppose the answer to part (a) gives the following sinusoids:
 $i_s(t) = 6\cos(2000t + 20^\circ)$ A, $i_L(t) = 10\cos(2000t - 30^\circ)$ A. Find the total energy stored in the mutual inductance pair at $t = 1$ msec. (**NOTE:** this is not the answer to part (a) HINT: beware of mixing radians & degrees)

- a) $I_L = 1\angle 31.6$ A
 b) 166 mJ

4. A single-phase transformer is rated 100 kVA, 2400 V:120 V and has the following approximate equivalent circuit parameters referred to the high voltage side:

$$R = 1.44 \, \Omega, \quad X = 4.32 \, \Omega, \quad R_c = 1.75 \, \text{k}\Omega, \quad X_m = 700 \, \Omega$$

Determine the Voltage Regulation and Efficiency when rated load is supplied at 120V and 0.8 **lagging** pf.

$$\text{VR} = 6.6\%$$

$$\eta = 92.76\%$$