The Ohio State University
Department of Electrical Engineering
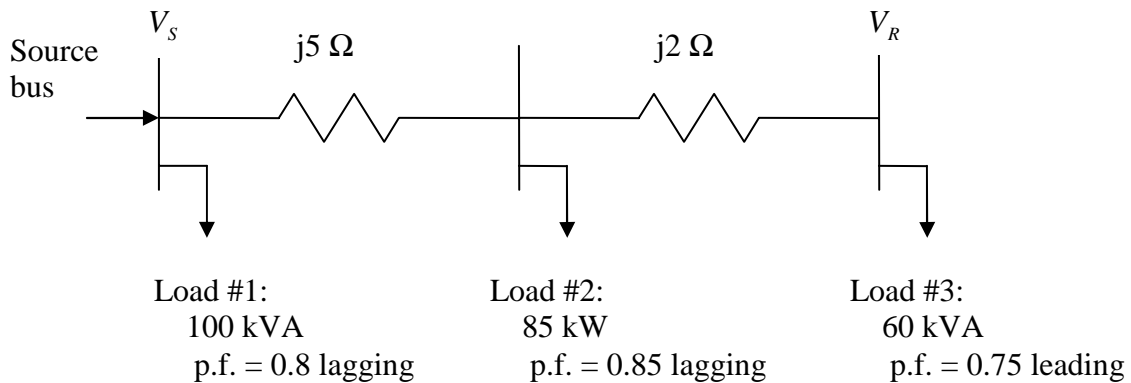
EE 341

Energy Conversion
Home work Set # 2

Print Your Name

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# The Last Four Digits of Your OSU I.D. number:

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Problem 1: Consider a 3-φ distribution system as shown below:

Source bus — V_S — j5 Ω — j2 Ω — V_R

Load #1:
100 kVA
p.f. = 0.8 lagging

Load #2:
85 kW
p.f. = 0.85 lagging

Load #3:
60 kVA
p.f. = 0.75 leading

Compute the following:
1) The source voltage V_S, if V_R is to be maintained at 2.2 kV.
2) The source current and power factor at the source.
3) The total complex power supplied by the source.
4) How much reactive power should be connected to the source bus for obtaining unity power factor at the source bus?
5) Write Matlab code to solve the above problems. Please submit the Matlab code and the results.

Problem 2: A balanced three-phase, three-wire feeder has three balanced loads as shown:

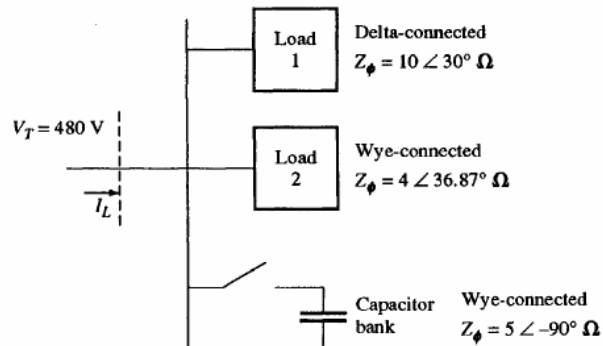Load 1   Load 2   Load 3
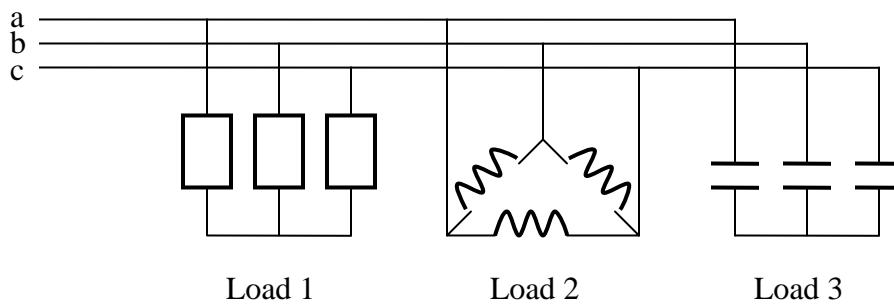
Load 1 are three lamps, each rated 100 watts at 120 volts. Load 2 are three inductors, each having an inductance of 0.1 Henry. Load 3 are three capacitors, each having a capacitance of 100 μF.

The line-to-line voltage on the feeder is 220 volts, and the frequency is 60 Hz. Find the source current in the feeder lines and the power delivered by the source.

Problem 3: Solve problem A-4 (textbook, page 673) See next page:

Problem 3: Solve problem A-4 (textbook, page 673)

A-4. Figure A-19 shows a small 480-V distribution system. Assume that the lines in the system have zero impedance.

$V_T = 480$ V

I_L

Load 1 — Delta-connected $Z_\phi = 10 \angle 30°\ \Omega$

Load 2 — Wye-connected $Z_\phi = 4 \angle 36.87°\ \Omega$

Capacitor bank — Wye-connected $Z_\phi = 5 \angle -90°\ \Omega$

(a) If the switch shown is open, find the real, reactive, and apparent powers in the system. Find the total current supplied to the distribution system by the utility.

(b) Repeat part (a) with the switch closed. What happened to the total current supplied? Why?