Power System Analysis I *** Midterm I ***Sample problems

P1 (50pt): A single-phase source supplies power to a single-phase load. The load is a small manufacturing plant absorbing 40 kVA at 0.8 power factor **lagging** from the source. Assume the source voltage is 220 V and the frequency is 50 Hz.

a) Does this plant need power factor correction? In either case, explain your reasoning.

b) For this plant, find the minimum value of the shunt capacitance in order to satisfy the regulation requirements that regulate the reactive power usage in Turkey.

c) While the shunt capacitor is in place, a new load is added to the plant. The new load absorbs 28 kW at 0.87 **leading** power factor. Analyze the new case and draw the power triangle for the source side. Does this new case require a new action as far as the regulations are concerned?

Answers:

a)

b) 1.1575 mF

c)

P2 (50pt): An ideal balanced three-phase, 50 Hz, positive sequence, Y-connected generator has an internal impedance of 0.25+j0.5 Ω/phase and supplies power to two balanced three-phase loads that are connected in parallel. The generator feeds these two loads through a line having an impedance of 0.3+j2.0 Ω/phase. One of the loads is Y-connected with an impedance of 25+j15 Ω/phase. The other load is Δ-connected with an impedance of 60-j9 Ω/phase. The line-to-line voltage across the load terminals is $\bar{V}_{BC} = 440\angle -80°$.

a) Calculate the Delta load current.

b) Calculate the line-to-line voltage across the generator terminal.

c) Calculate the complex power delivered by the generator.

d) Check that the total active power delivered by the generator is equal to the total active power absorbed by the line and the load.

Answers:

a) IAB=7.251/_48.53, IBC=….

b) Vab=464.3/_48.4, Vbc=……

c) 15511.2+j4418.48

d)