Power System Analysis I Midterm I Sample problem with answers

P1 (15): Consider a single-phase load with an applied voltage of $v(t) = 200\sin(\omega t + 40°)$ Volts and a load current of $i(t) = 50\sin(\omega t - 20°)$ Amperes.

a) Find the real and reactive power absorbed by the load.

b) Find the power factor and specify whether it is lagging or leading.

Answers

a) P=2500 W, Q=4330 Var

b) 0.5 lagging

P2 (40): A single-phase source supplies power to two single-phase loads connected in parallel in a manufacturing plant. The first load absorbs 40 kVA from the source at 0.95 power factor **leading**. The second load is an inductive load (motor) and absorbing 62 kW active power and 50 kVar reactive power from the source. Assume the source voltage is 220 V and the frequency is 50 Hz.

a) Find the power factor of the source.

b) Does this plant need power factor correction based on the reactive power regulation requirements that are issued in Turkey? If your answer is "yes," explain why.

c) Find minimum value of the shunt capacitance in order to satisfy the reactive power regulation requirements in Turkey.

d) What is the power factor of the source after the power factor correction?

Answers

a) 100 kW, 37.5 kVar, 0.9363

b) Yes. Explain….

c) 1.15 mF

d) 0.98

P3 (45): A balanced three-phase, 50 Hz, positive sequence, Y-connected generator has an internal impedance of $1 + j3$ 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 $5 + j5$ Ω/phase. One of the loads is Δ-connected with an impedance of $-j60$ Ω/phase. The other load is Y-connected with an impedance of $40 + j20$ Ω/phase. The line-to-line voltage across the generator terminals is $\bar{V}_{ab} = 500\angle 20°$.

a) Calculate the line currents.

b) Calculate the line-to-line voltages across the load terminals.

c) Calculate the total active and reactive power absorbed by the load.

Answers

a) Ia=13.6/_35degree, Ib=…, Ic=…

b) Vab=526.7/_1.57degree, Vbc=…, Vca=…

c) 5549.7 W, 11096.93 Var Capacitive