EEL/ ELL 100: Principles of Electrical Engineering

Department of Electrical Engineering

Minor II

October 8, 2014

Time: 1 Hour

Max. marks: 50

Question1 *10 marks*

For the circuit shown in figure 1,

(a) find the source voltage V_S, power and the power factor. [8]

(b) If the source power factor is to be improved without changing the rest of the circuit elements, what would you do? [2]

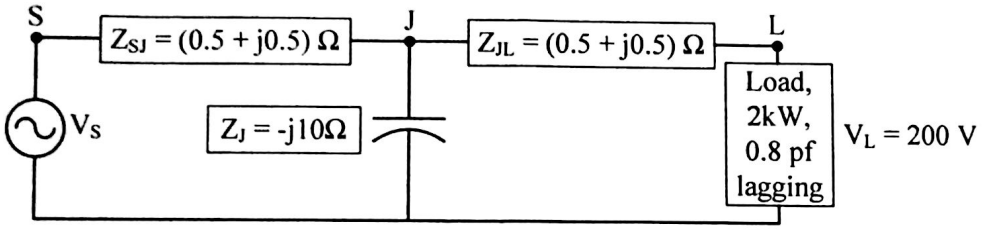

Figure 1: Circuit for Question 1

Question2 *10 marks*

A signal source supplies a current $i = 20\sqrt{2}\cos(2000t)mA$ to a series RLC circuit. Meters are arranged to read the voltage across the capacitor and the total voltage. The capacitor is adjusted until the total voltage across the RLC series circuit is a minimum which is $2V$ and the voltage across the capacitor is $40V$.

(a) Calculate the resistance R, inductance L, capacitance C and the quality factor. [7]

(b) With the same signal source and the same values of R and L as in the above case, what value(s) of capacitor shall make the total voltage $4V$. [3]

Question3 *10 marks*

The maximum efficiency of a $500kVA$, $3300/500V$, $50Hz$, single phase transformer is 97% at 75% of full load and unity power factor. The voltage regulation of the transformer at full load and 0.8 power factor lagging is 7.5%. Evaluate the voltage regulation of the transformer at 75% of full load and 0.8 power factor leading.

Question4 *10 marks*

As shown in figure 2, a balanced delta connected generator supplies 3 phase power to two balanced loads connected in parallel. The line to line voltage at the generator terminals is $V_{LL} = 400V$. One load is star connected with impedance at each leg $Z_1 = 10\angle 30°\Omega$. Another load is delta connected with impedance at each leg $Z_2 = 20\angle 45°\Omega$.

(a) Find the phase current, phase voltage and power in each load. [6]

(b) What is the line current? [1]

(c) Also evaluate the total power, phase current and power factor at the generator. [3]

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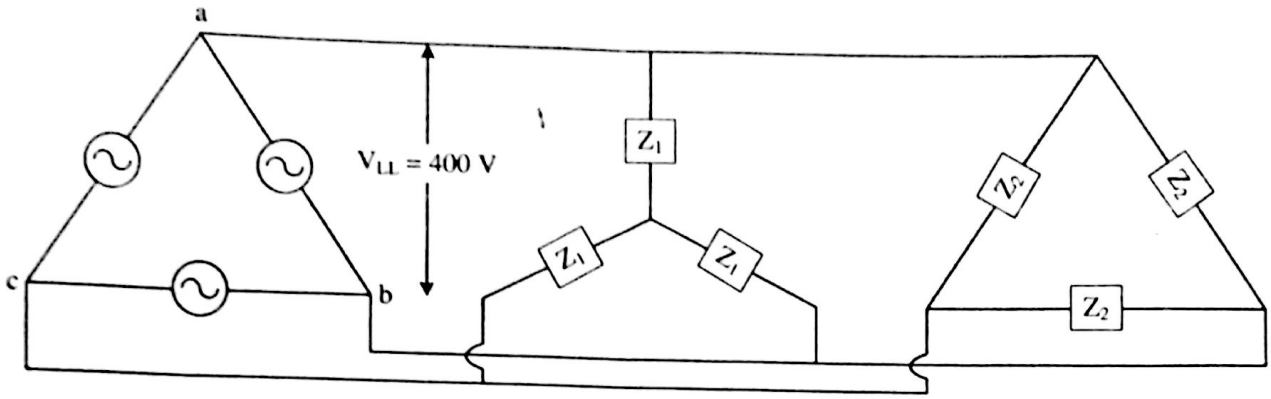

Figure 2: Circuit for Question 4

Question5 ***10 marks***

For the magnetic circuit shown in the figure 3, find out the current to be supplied by the coil for setting up the flux $\varphi_{ag} = 4mWb$ in the air gap. The coil consists of 3000 turns. The circuit consists of iron core whose relative permeability is 2500. The dimensions of the limbs are $EFAB = BCDE = 50cm$ and $BG = HE = 10cm$. The air gap $GH = 2mm$. The area of the entire cross section is $40cm^2$ throughout. Neglect fringing effects.

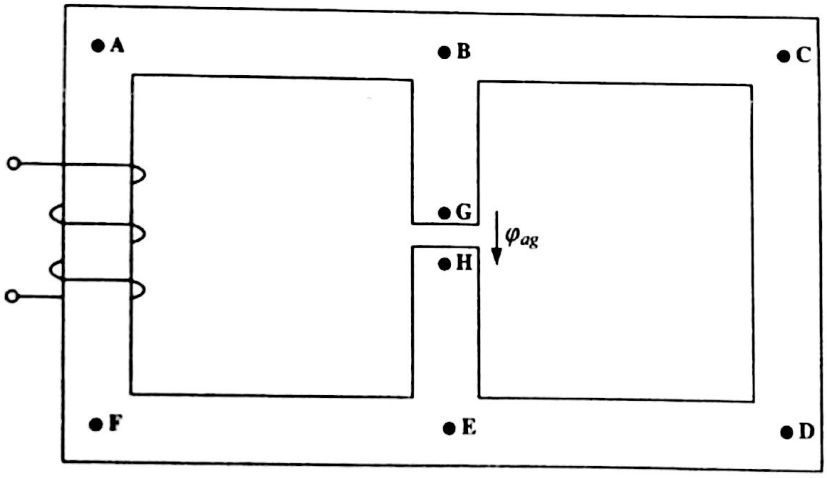

Figure 3: Circuit for Question 5