1. (20%) Explain the following terms. (4% each)

   (a) apparent power, (b) susceptance, (c) 3-dB frequency, (d) fundamental cutset, and (e) zero-state response

2. (20%) In Figure 2, $i_s(t) = 20\sin 0.125t$ A. Find the steady state value of $v_C(t)$.

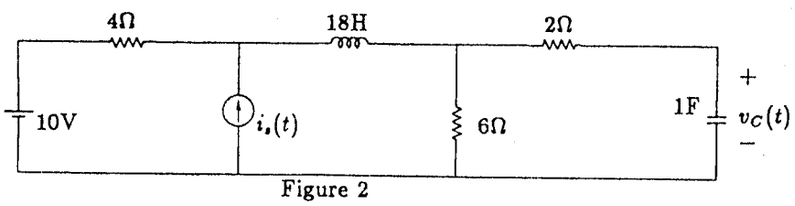


Figure 2

3. (20%) In the ideal transformer circuit shown in Figure 3, $\mathbf{I}_2$ is $50\angle 53.1°$ A and $\mathbf{I}_3$ is $5\angle 90°$ A. Find $\mathbf{I}_1$.

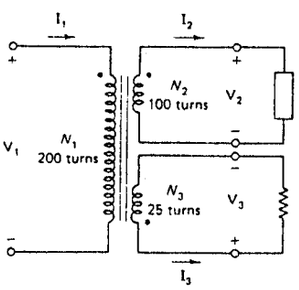


Figure 3

4. (20%)

   (a) Find the Thévenin equivalent circuit with respect to the terminals $a$, $b$ for the circuit shown in Figure 4.

   (b) Find the load impedance $Z_L$ if maximum average power is delivered to $Z_L$.

   (c) Find the maximum average power delivered to $Z_L$.

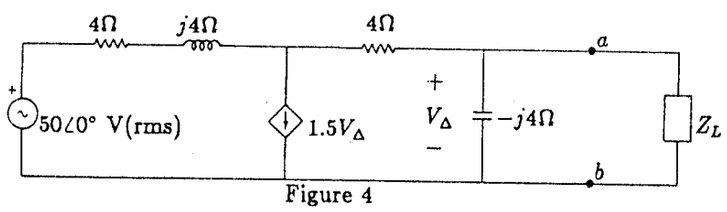


Figure 4

5. (20%) A three-phase Δ-connected load with per-phase impedance of $40 + j25\,\Omega$ is properly connected to a balanced three-phase 380 V, 60 Hz power supply. A $Y$-connected capacitor bank is in parallel with the load to improve power factor seen by the source with 0.9 power factor lagging. Assume the power factor of the capacitor bank is 0.17 leading (per phase). Determine:

   (a) per-phase capacitance of the capacitor bank, (5%)

   (b) the active power absorbed by the capacitor bank, (5%)

   (c) the line current and the complex power delivered by the source (5%), and

   (d) the values of $R$ and $C$ if the per-phase capacitor bank is an equivalent series $RC$ circuit. (5%)