Tutorial 1: Single Phase AC Systems – The Basics

Q1 State the rms value of the following waveforms:

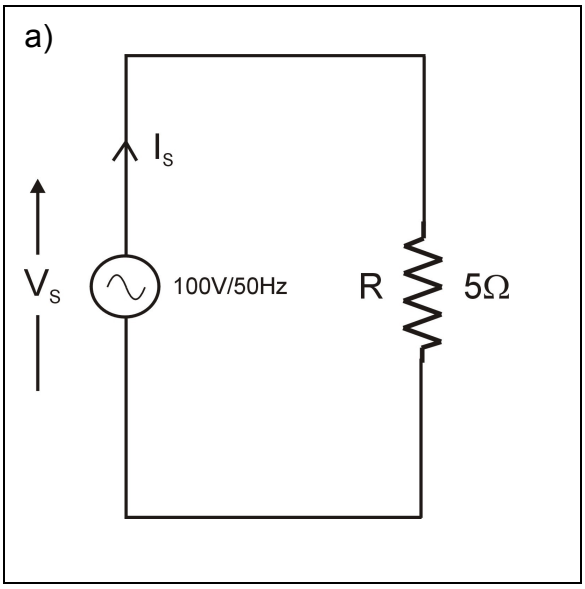
a) $v(t) = 141.Sin(\omega t)$

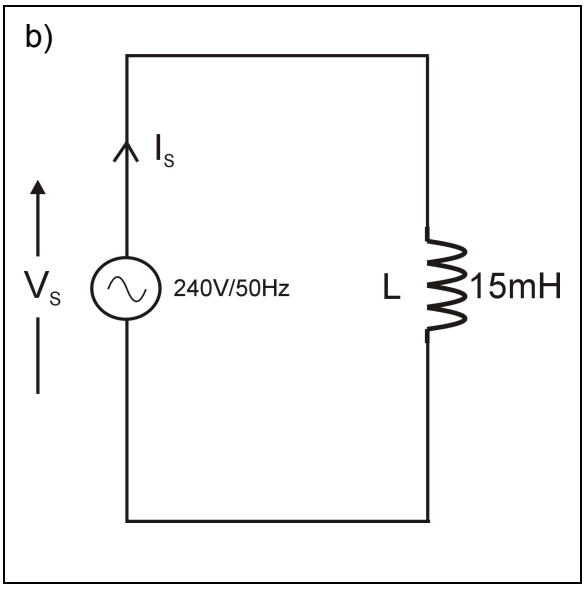
b) $i(t) = 20.Sin(\omega t - \frac{\pi}{4})$

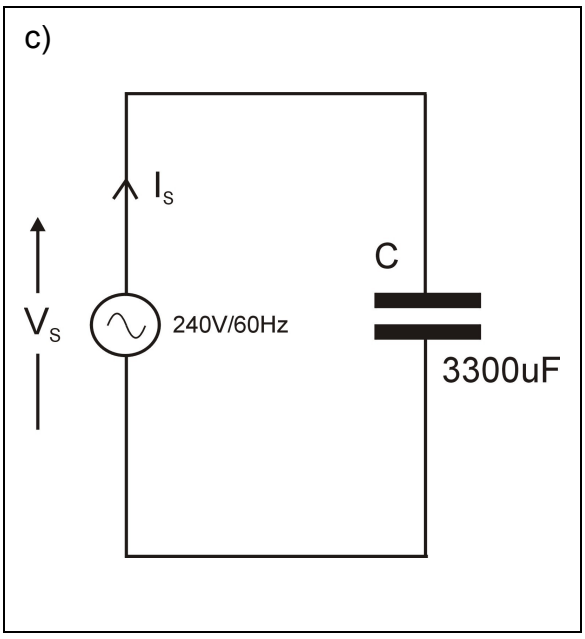
Q2 Draw the Q1 instantaneous voltage and current waveforms as a function of time (on the same graph please)

Q3 Draw the equivalent phasors (on the same diagram please) for the Q1 voltage and current. Does the current LEAD or LAG the voltage?

Q4 Draw a phasor diagram showing V_S and I_S for each of the following single component circuits, and determine the rms current magnitude in each case.







Q5 Determine the Reactance and Complex Impedance of the following components when connected to a 110V/60Hz (USA) supply:

a) L = 220mH
b) C = 220μF

Q6 Convert the following Complex Impedances (Cartesian form) into their Polar equivalent.

a) 15 + j10
b) 20 – j30

Q7 Convert the following voltage phasors (Polar form) into their Cartesian equivalent:

a) 200Φ20°
b) 100Φ(-40°)

(note Φ indicates that the value following it is the phasor angle (in degrees))

Q8 For the circuit shown on Figure Q8 (where V_S = 110V/50Hz) determine the following:

a) The Inductance (L).
b) The supply current I_S.
c) Draw the phasor diagram for the supply voltage (V_S) and current (I_S)
d) Determine the average output power
e) Determine the average input power
f) Determine V_R and V_L and add these to the phasor diagram

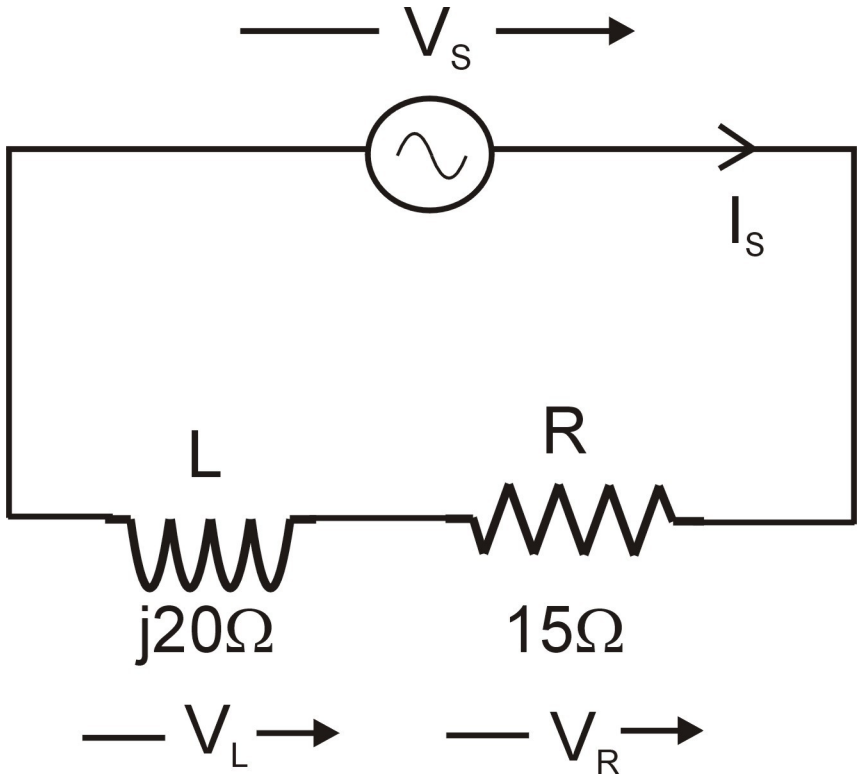


Figure Q8

Q9 For the circuit shown on Figure Q9 (where V_S = 11kV/50Hz) determine the following:

a) The total circuit impedance Z_T.
b) The supply current I_S.
c) Draw the phasor diagram for the supply voltage (V_S) and current (I_S)

Bonus:

d) Determine the new value of capacitance (C) which would result in the supply voltage and current being IN PHASE.

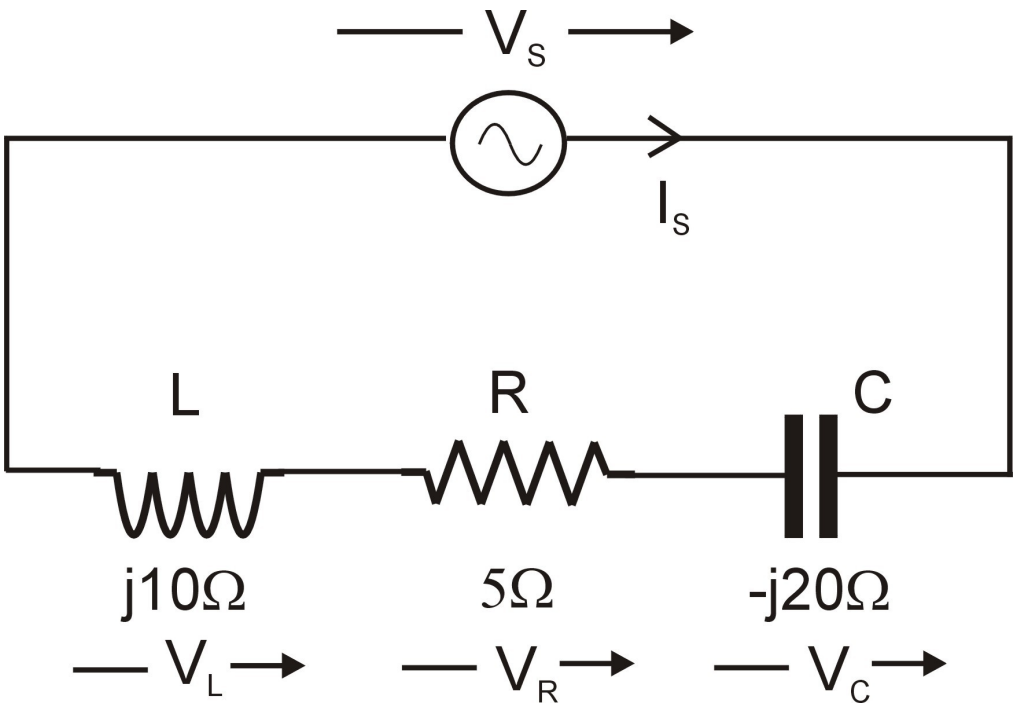


Figure Q9