CG1111 Engineering Principles and Practice I

Tutorial for Week 7

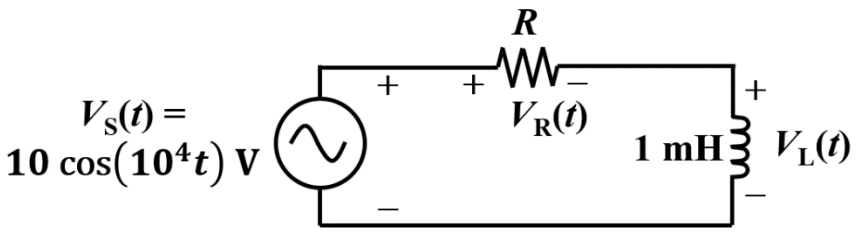
AC Circuit Analysis and AC-to-DC Conversion

1. The circuit in the figure below is supplied by a sinusoidal voltage source.

   a. Find the expression for $V_R(t)$.

   b. What is the value of resistance R for the phase difference between $V_S(t)$ and $V_R(t)$ to be 45°?

   c. Draw the phasor diagram showing $V_S(t)$, $V_R(t)$, and $V_L(t)$.

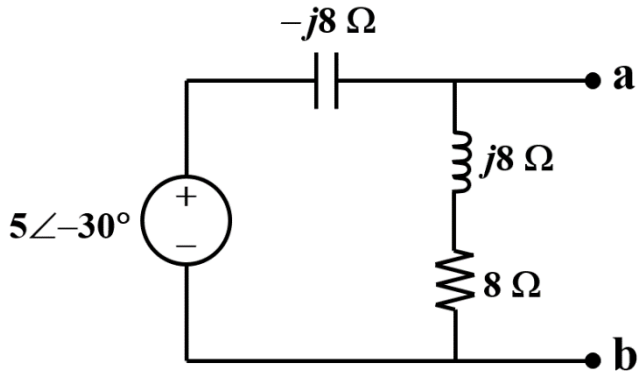


Ans:

a) $V_R(t) = \frac{RV_m}{(\sqrt{R^2+\omega^2L^2})}\cos(\omega t - tan^{-1}\frac{\omega L}{R})$

b) 10 Ω

2. For the circuit given below, find the Thevenin equivalent seen across terminals **a** and **b**.



Ans:

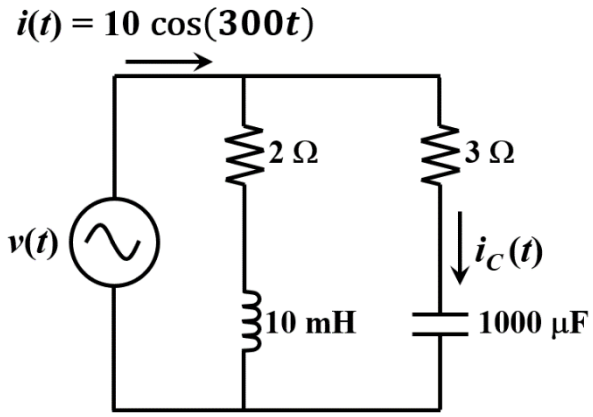
$V_{Th} = 5\sqrt{2}\angle 15°$

$Z_{Th} = 8 - j8\ \Omega$

3. The circuit in the figure below is supplied by a sinusoidal voltage source.

   a. Find the voltage $v(t)$.

   b. Find the current $i_C(t)$.

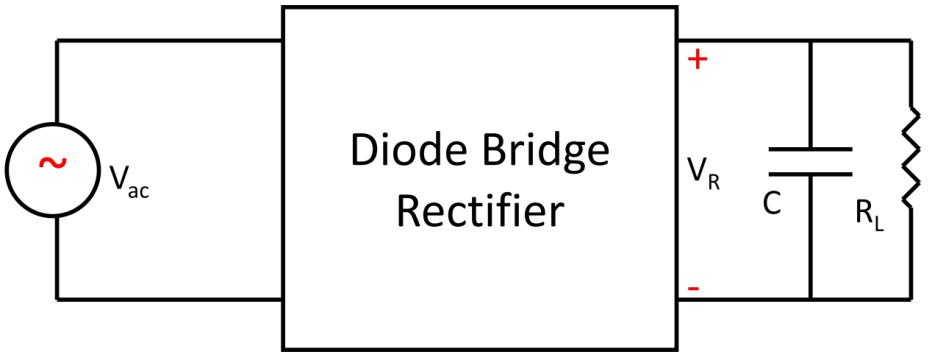


Ans:

a) 32.3 cos (300t + 12.1°) V

b) 7.2 cos (300t + 60.1°) A

4. Derive an expression for the voltage ripple at the load R_L in the following circuit, in terms of the average load voltage V_{Load}, the AC power supply's frequency f_s, the capacitance C, and the load resistance R_L.



5. The above circuit needs to deliver a current of 0.2 A with an average voltage of 15 V. The AC source has a frequency of 50 Hz. The peak-to-peak voltage ripple is to be less than 0.5 V. Assume the diodes are ideal with no voltage drop. Find the minimum value of the filter capacitor needed.

   Ans: 4 mF