EEL 3112c – Circuits 2

<u>Quiz on Chapter 9</u>

Notes:

- Write your name on **all** pages
- Time limit is 20 minutes
- The quiz is closed book and closed notes
- You are allowed to use a calculator
- Show your work not just the final answer
- Your answers must be organized and easy to follow

Problem 1: (3 points)

Consider the sinusoidal voltage $v(t) = 40\cos(200\pi t + 30°)$

   a) What is the maximum amplitude of the voltage? (0.5 points)
   b) What is the frequency in hertz? (0.5 points)
   c) What is the frequency in rad/s? (0.5 points)
   d) What is the period in milliseconds? (0.5 points)
   e) What is the first time after $t = 0$ that $v = 0\ V$? (0.5 points)
   f) What is the phasor representation (**V**) of $v(t)$? (0.5 points)

Solution:

   a) $V_m = 40\ V$
   b) $2\pi f = 200\pi \rightarrow f = 100 Hz$
   c) $\omega = 200\pi = 628.318$ rad/s
   d) $T = \dfrac{1}{f} = \dfrac{1}{100} = 10\ ms$
   e) $200\pi t + \dfrac{\pi}{6} = \dfrac{\pi}{2} \rightarrow 200\pi t = \dfrac{\pi}{3} \rightarrow t = \dfrac{1}{600} = 1.67\ ms$
   f) $V = 40\angle 30°$

Problem 2: (2 points)

A 80 kHz sinusoidal voltage has zero phase angle and a maximum amplitude of 25 mV. When this voltage is applied across the terminals of a capacitor, the resulting steady-state current has a maximum amplitude of 628.32 μA.

a) What is the frequency of the current in radians per second? (1 point)
b) What is the phase angle of the current? (0.5 point)
c) Using the phasor voltage and current, what is the impedance Z_C? (1 point)

Solution:

a) $\omega = 2\pi f = 2\pi(80 \times 10^3) = 160\pi \times 10^3 = 502{,}654.82 \; rad/sec$

b) In pure capacitive loads, the current leads the voltage

$$\theta_i = \theta_v + 90° = 0 + 90 = 90°$$

c) $Z_C = \dfrac{V}{I} = \dfrac{25 \times 10^{-3} \angle 0°}{628.32 \times 10^{-6} \angle 90°} = 39.79 \angle -90° = -j39.79 \; \Omega$