ECE 3 HW 5

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We have

$$Z_c = \frac{1}{j\omega C} = -j10^2$$

And the phasor of the voltage source is

$$V = 10V$$

Therefore for the open circuit voltage we have the following equations for the voltage

$$v_1$$

across the capacitor

$$4I_x = \frac{v_1}{Z_c}$$

$$10 - v_1 = 50I_x$$

Solving them we get

$$I_x = 0.0031 + 0.0246j$$

$$v_1 = 9.8462 - 1.2308j$$

Therefore we have that the phasor for V_{oc} is

$$V_{oc} = 10 - (v_1 + 20 \cdot 3I_x) = \boxed{(-0.0308 - 0.2462j)V}$$

And therefore we have

$$V_{oc} = \boxed{0.2481\cos(1000t - 0.5396\pi)}$$

For the short circuit current we have the following equation

$$I_x = \frac{10 - v_1}{50}$$

$$I_x + \frac{10 - v_1}{20} = \frac{v_1}{Z_c}$$

Solving these we get

$$I_x = (0.004 + 0.028j)A$$

$$v_1 = (9.8 - 1.4j)V$$

And we have the current across the short is

$$I_{no} = \frac{10 - v_1}{20} - 3I_x = (-0.002 - 0.014j)A$$

Therefore we have the equivalent resistance is

$$Z_{th} = \frac{V_{th}}{I_{no}} = \boxed{(17.5385 + 0.3077j)\Omega}$$