Name: _____ (please print)

Signature: _____

ECE 2202 Quiz 4
November 5, 2020
Online

1. This quiz is open book, open notes.
2. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz, and 15 minutes to download/print, scan and submit.

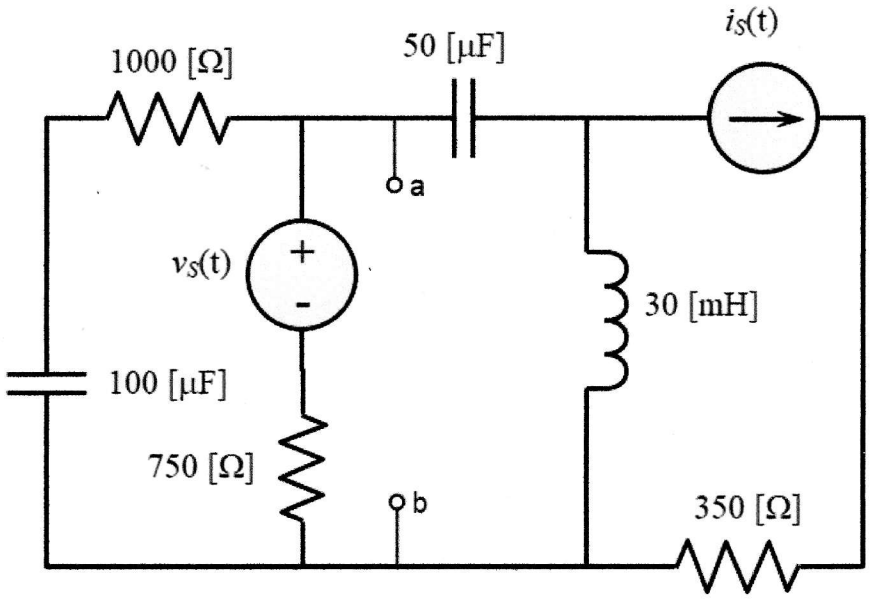
_____/25

Room for extra work

For the circuit below, the sources are given as follows.

$$v_S(t) = 12[V]\cos(377t)$$
$$i_S(t) = 40[mA]\cos(377t + 20^o)$$

a) Draw this circuit in the phasor domain.
b) Find the Thevenin equivalent circuit at terminals a, b, and draw the equivalent circuit in the phasor domain.
c) Convert the Thevenin equivalent circuit to the time domain. To do this, you will need to convert the Thevenin impedance to resistors, capacitors, and inductors as appropriate.



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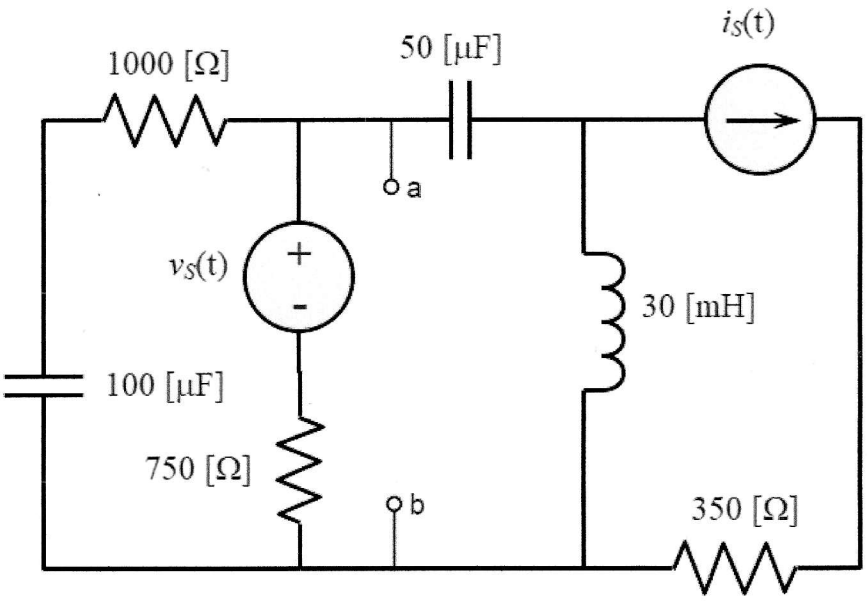
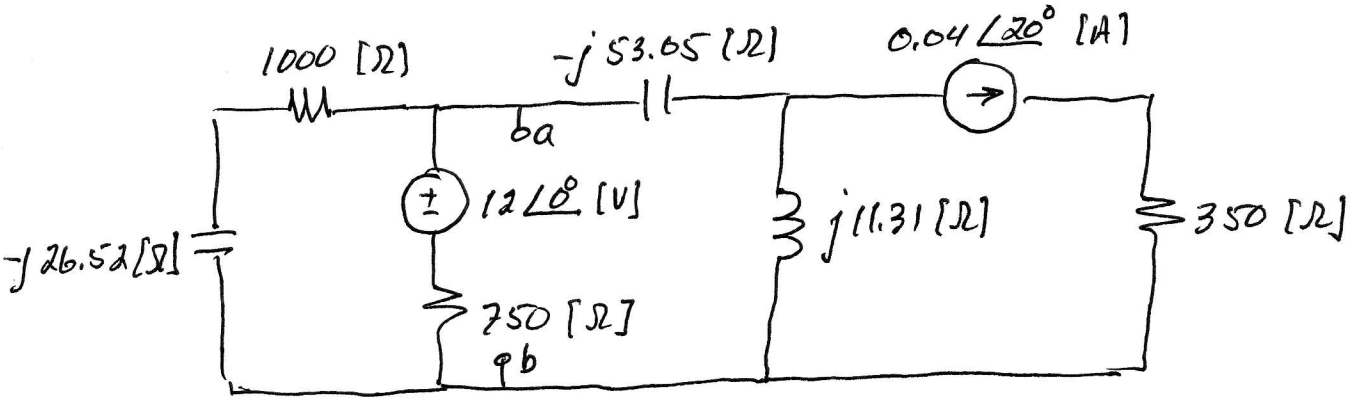


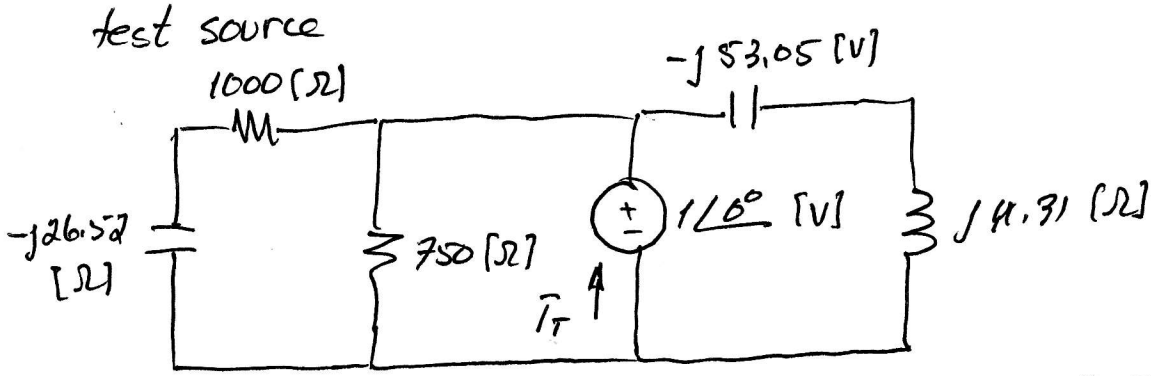
a) $\omega = 377 \left[\frac{rad}{s}\right]$ $\quad C \rightarrow \frac{1}{j\omega C}$ $\quad L \rightarrow j\omega L$



Room for extra work

b) We will need two of • open-ckt voltage • short-circuit current • test source. Here we will do all three.

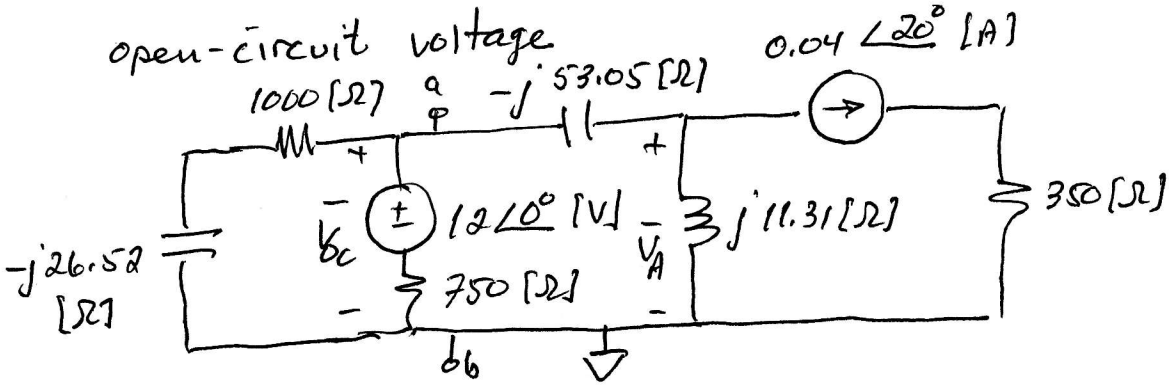
test source



$$\bar{I}_T = \frac{1}{750} + \frac{1}{-j(53.05+11.31)} + \frac{1}{1000-j26.52} = \begin{matrix} 2.333 + j\,23.98 \text{ [mA]} \\ 24.098 \angle 84.44^\circ \text{ [mA]} \end{matrix}$$

$$\boxed{Z_{TH} = \frac{1}{\bar{I}_T} = 4.019 - j\,41.30 \text{ [Ω]}}$$

open-circuit voltage



$$\frac{\bar{V}_{oc}-12}{750} + \frac{\bar{V}_{oc}}{1000-j26.52} + \frac{\bar{V}_{oc}-\bar{V}_A}{-j53.05} = 0$$

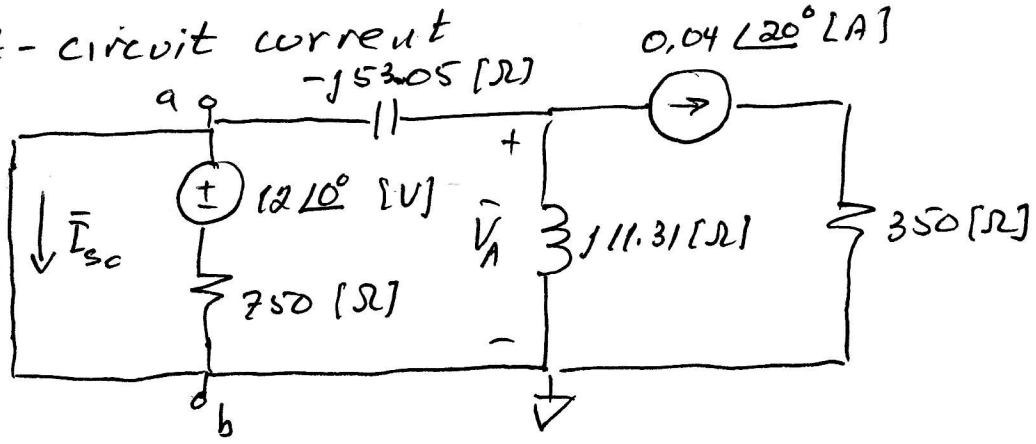
$$\frac{\bar{V}_A-\bar{V}_{oc}}{-j53.05} + \frac{\bar{V}_A}{j11.31} + 0.04\angle 20^\circ = 0$$

$$\bar{V}_{oc} = 0.2583 - j\,1.0666 \text{ [V]} = 1.0974 \angle -76.39^\circ \text{ [V]}$$

p.2

Room for extra work

Short-circuit current



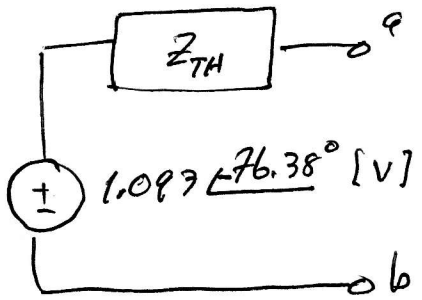
$$\frac{\bar{V}_A}{j13.11} + 0.04\angle 20° + \frac{\bar{V}_A}{-j53.05} = 0 \qquad \bar{V}_A = 0.19666 - j\,0.54031 \text{ [V]}$$

$$\bar{I}_{sc} = \frac{\bar{V}_A}{-j53.05} + \frac{12}{750} = 0.026185 - j\,0.0037071 \text{ [A]}$$

$$26.446\angle -8.058° \text{ [mA]}$$

$$\frac{\bar{V}_{oc}}{\bar{I}_{sc}} = 4.017 - j\,41.302 \text{ [Ω]}$$

This is the same (within round-off error) as from the test source.



$$Z_{TH} = 4.017 - j\,41.30 \text{ [Ω]}$$

$$\Rightarrow R = 4.017 \text{ [Ω]}$$

$$-41.30 = -1/\omega C \Rightarrow C = 64.23 \text{ [μF]}$$

c)