1) In a DC circuit when steady-state conditions are reached a Capacitor acts like a what?

2) In a DC circuit when steady-state conditions are reached an Inductor acts like a what?

3) The circuits below have been sitting for a long time; apply the steady-state conditions of the Capacitor and the Inductor to determine the voltages at terminals a-b. (Assume the Capacitors and Inductors are ideal).

![Circuit Diagram 1](image1)

![Circuit Diagram 2](image2)
4) Initially the switch is at **Position 1** for a long time and then moves to **Position 2**. Determine the initial Voltage ($V_o$) across the Capacitor.

![Circuit Diagram]

$$V_c = 5 \mu F$$

5) Redraw the circuit in Position 2 and determine the equivalent Resistance ($R_{eq}$) as seen by the Capacitor. Also determine the time constant ($\tau$) and the final Voltage ($V_f$) across the Capacitor.

6) Develop the transit response equation for the Voltage across the Capacitor and plot the response below. Make sure to include the time (in milliseconds) when steady-state is reached.
7) Initially the switch is at **Position 2** for a long time and then moves to **Position 1**. Determine the initial Current \( i_o \) through the Inductor.

8) Redraw the circuit in Position 1 and determine the equivalent Resistance \( R_{eq} \) as seen by the Inductor. Also determine the time constant \( \tau \) and the final Current \( i_f \) through the Inductor.

9) Develop the transit response equation for the Current through the Inductor and plot the response below. Make sure to include the time (in milliseconds) when steady-state is reached.
10) How long will it take for the Current through the Inductor to reach 1.94 mA and what will be the energy stored in the Inductor at this point in time?

11) Express the Voltage Sources as a phasor.

\[
21.21 \sin(160t - 63^\circ) \text{ V}
\]

12) Find the Impedance values for the given elements.

a. Let \( f = 60 \text{ Hz} \)

\[
132.63 \text{ mH}
\]

b. Let \( \omega = 235 \text{ rad/s} \)

\[
193.42 \text{ \mu F}
\]

c. Let \( \omega = 1500 \text{ rad/s} \)

\[
80.5 \Omega
\]
13) Redraw the circuit below. Express the source in phasor form and the elements as Impedances.

19.8sin(377t + 30°) V

14) Find the total Impedance as seen by the Source.

15) Find (I_s), (I_1), (I_2), and (I_3). Use Current Divider Rule when finding (I_1), (I_2), and (I_3).
16) Find the voltage across the Inductor (\(V_L\)).

17) When solving Thevenin Equivalent problems there are logical steps that hold true no matter if the circuit is DC or AC. Answer the following with True or False.

a. _____ If a Load is shown on the circuit, the first step is to remove the Load.
b. _____ The Thevenin Impedance is always the impedance as seen by the Source.
c. _____ When solving the Thevenin Impedance, we must “turn off” the sources by replacing both current and voltage sources as SHORTS.
d. _____ When solving the Thevenin Impedance, we must “turn off” the sources by replacing the current source a SHORT and the voltage sources as an OPEN.
e. _____ When solving the Thevenin Impedance, we must “turn off” the sources by replacing the current source an OPEN and the voltage sources as a SHORT.
f. _____ When finding the Thevenin Voltage we use the open terminals were the Thevenin perspective is.

18) Find the Thevenin Impedance and Voltage external to \(Z_{Load}\) for the circuit below. Draw the Thevenin circuit with the Load attached.
19) Is Maximum Power being delivered to the Load and why?

20) The acronym used for Capacitors in AC circuits is “ICE”. Explain what is meant with this acronym.

21) The acronym used for Inductors in AC circuits is “ELI”. Explain what is meant with this acronym.

The Graph and circuit below are for questions 22 through 25
22) For the Graph on the other page answer the following questions.
   
a. What is the period \((T)\) of the waveforms?

   b. What is the frequency of the waveforms \((f)\)?

   c. What is the time difference \((\Delta t)\) between \(V_s\) and \(V_R\)?

   d. What is the phase difference \((\Delta \theta)\) between \(V_s\) and \(V_R\)?

   e. Write the function for \(V_s(t)\).

   f. Express \(V_s(t)\) in phasor form.

   g. Write the function for \(V_R(t)\). (Use \(V_s\) as the reference angle)

   h. Express \(V_R(t)\) in phasor form.

23) Since we know \(V_s\) and \(V_R\), find the voltage across the Load \((V_L)\). Refer to the circuit at the bottom of the other page. (Hint: use KVL)

24) Find \(Z_{Load}\); Is the Load Capacitive or Inductive?

25) Draw the Load equivalent circuit below.
26) The following circuit is operating at a frequency of \( \omega = 500 \text{ rad/s} \).

\[ \omega = \frac{2233}{s} \]

a. Draw the Power Triangle for the Load and label the Apparent, Real, and Reactive Power. Also include the Complex Power angle.

b. Find the source current \( I_s \).

c. Typically we like to reduce the source current. This can be accomplished by connecting a Capacitor in parallel to an Inductive Load. The Capacitor component value \( C \) is determined by choosing a Capacitance Reactive Power \( Q_c \) equal to the Inductance Reactive Power \( Q_L \).

Find the Capacitor component value so all of the Reactive Power at the Load is cancelled. In other words, what component value will correct the power factor to unity?