Date: _____

Name: _____ Partners Approval: _____

Name _____ Partners Approval: _____

EE114 Power Engineering I
Assignment 01

Instructions:

1. This is an individual assignment.
2. Show all of your work.
3. **Reading:** Chapter 09, 10 and 11 from Electric Circuits by Nilsson and Reidal
4. **Due Date:**

- **Question 1:** A sinusoidal voltage is given by the expression

$$v = 100cos(240\pi t + 45^\circ)mV \tag{1}$$

Find

1. frequency (f) in hertz.
2. Time constant (T) in millisecond.
3. V_m.
4. $v(0)$.
5. ϕ in degree and radians.
6. The smallest positive value of t at which $v = 0$.
7. The smallest positive value of t at which $dv/dt = 0$

- **Question 2: (30pts)** In a single graph $v = 60cos(\omega t + \phi)$ verse ωt for ϕ = -60°, -30°, 0°, 30° and 60°.

1. State whether the voltage function is shifting to the right or left as ϕ become more positive.
2. What is the direction of shift if ϕ changes from 0 to -30°.

- **Question 3:** Consider the sinusoidal voltage

$$v(t) = 170cos(120\pi t - 60^\circ) \tag{2}$$

1. What is the maximum amplitude of the voltage ?
2. What is the frequency in hertz ?

3. What is the frequency in radians per second ?
4. What is the phase angle in radians ?
5. What is the phase angle in degrees ?
6. what is the period in milliseconds ?
7. what is the first time after $t = 0$ that v =170 V ?
8. The sinusoidal function is shifted 125/18 ms to the right along the axis. What is the expression for $v(t)$?
9. What is the minimum number of milliseconds that the function must be shifted to the right if the expression for $v(t)$ is $170sin(120\pi t)$ V ?
10. What is the minimum number of milliseconds that the function must be shifted to the left if the expression for $v(t)$ is $170cos(120\pi t)$ V ?

- **Question 4:** Use the concept of the phasor to combine the following sinusoidal functions into a single trigonometric expression:

1. $y = 100cos(300t + 45°) + 500cos(300t - 60°)$
2. $y = 250cos(377t + 30°) - 150sin(377t + 140°)$
3. $y = 60cos(100t + 60°) - 120sin(100t - 125°) + 100cos(100t + 90°)$
4. $y = 100cos(\omega t + 40°) + 100sin(\omega t + 160°) + 100cos(\omega t - 80°)$

- **Question 5:** A 40 kHz sinusoidal voltage has zero phase angle and a maximum amplitude of 2.5 mV. When this voltage is applied across the terminals of a capacitor, the resulting steady-state current has a maximum amplitude of 125.67 uA.

1. What is the frequency of the circuit in radians per second ?
2. What is the phase angle of the current ?
3. What is the capacitive reactance of the capacitor ?
4. What is the capacitance of the capacitor in microfarads ?
5. What is the impedance of the capacitor ?

- **Question 6:** A 400 Ω resistor, 87.5 mH inductor and a 312.5 nF capacitor are connected in series. The series-connected elements are energized by a sinusoidal voltage source whose voltage is $500cos(8000t + 60°)$ V.

1. Draw the frequency-domain equivalent circuit.
2. What is the phase angle of the current ?
3. reference the current in the direction of the voltage rise across the source, and find the phasor current.
4. Find the steady-state expression for $i(t)$.

- **Question 7:**

1. For the circuit is Fig.1, find the frequency (in radians per second) at which the impedance Z_{ab} is purely resistive.
2. Find the value of Z_{ab} at the frequency of (1).

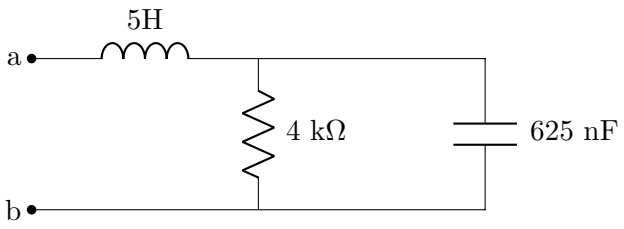

Fig.7

- **Question 8:** Find Z_{ab} for the circuit shown in Fig.2

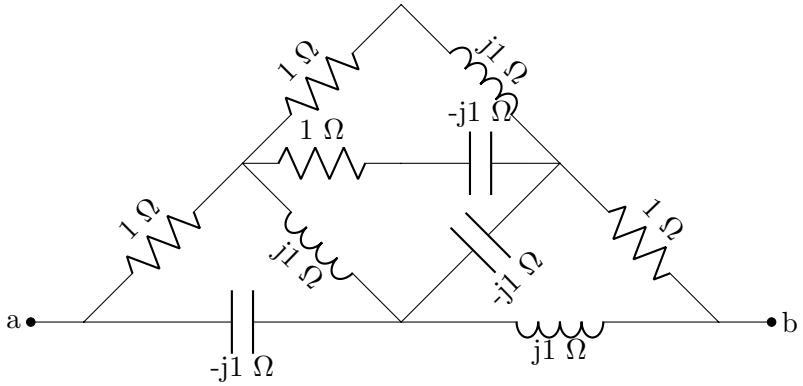

Fig.8

- **Question 9:** Find the Thevenin equivalent circuit with respect to the terminals a,b for the circuit shown in Fig.3

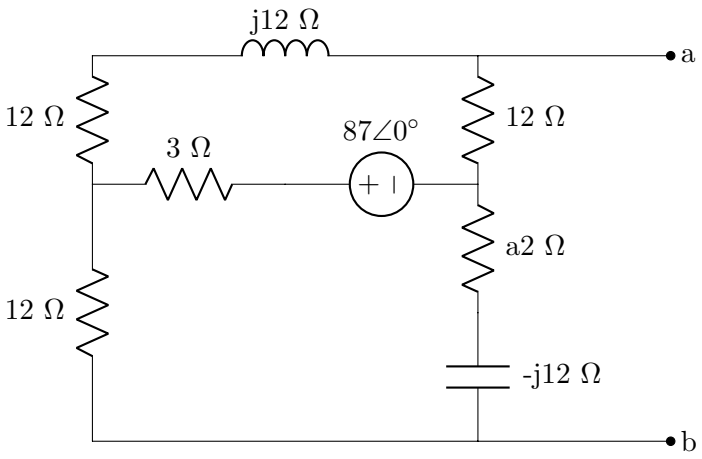

Fig.9

- **Question 10:** Find the Thevenin impedance seen looking into the terminals a,b of the circuit in Fig4 if the frequency of operation is 25 krad/s.

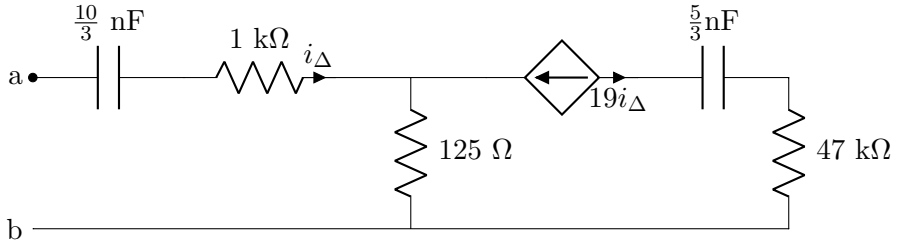

Fig.10

- **Question 11:** Use the node-voltage method to find the phasor voltage V_g in the circuit shown in Fig.5

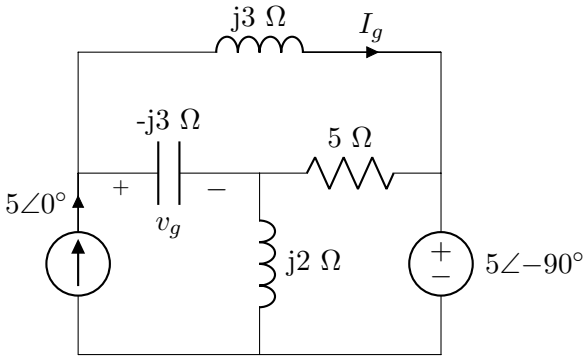

Fig.11