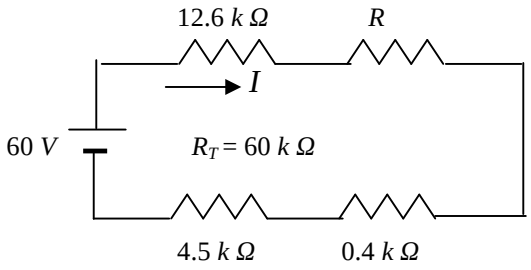
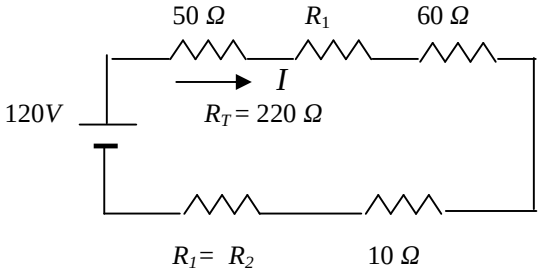
Electrical Engineering Fundamentals *EE-238*

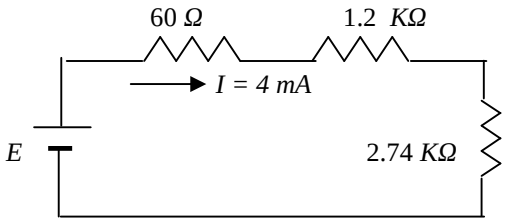
Sheet 1
Series Circuits

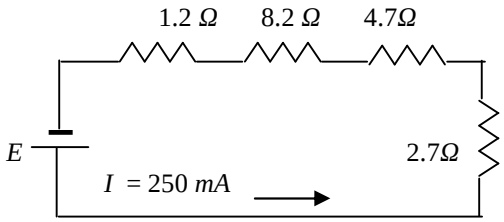
1- For the circuits shown below, the total resistance is specified. Find the unknown resistance and the current ***I*** for each circuit.



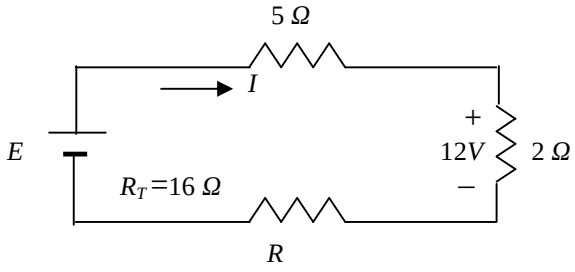


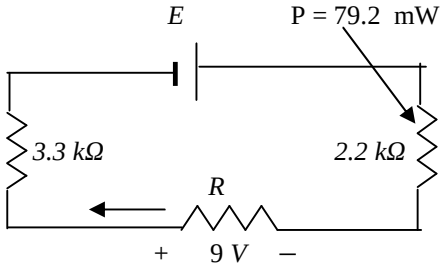
2- find the applied voltage ***E*** necessary to develop the current specified in each circuit below.



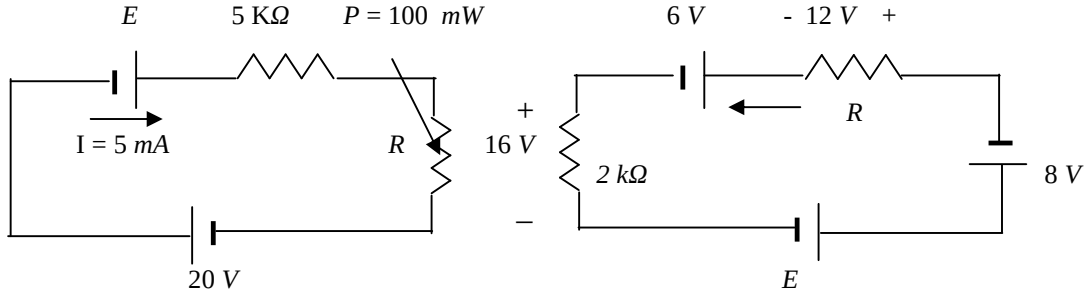


3- for each network, determine the current I, the source voltage E, the unknown resistance and the voltage across each element.

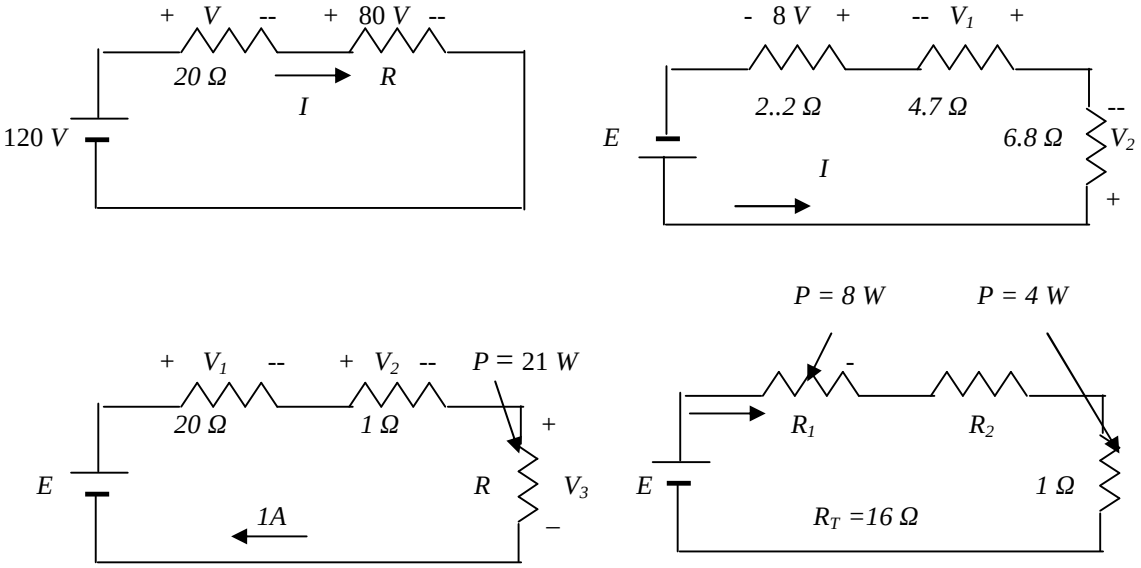




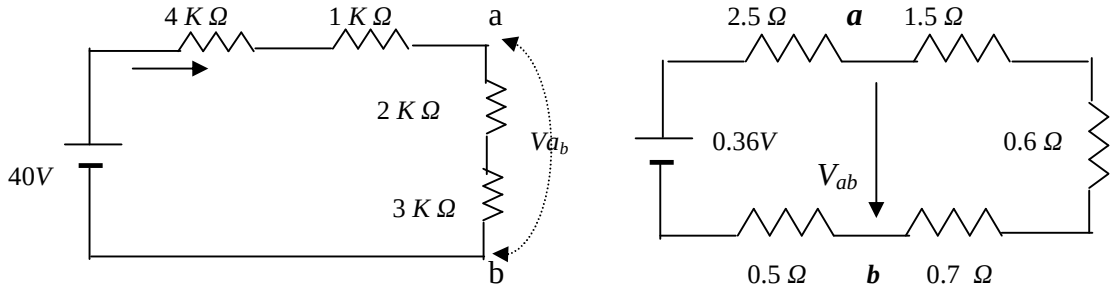
4- find the unknown voltage source and resistor for each of the networks shown below. Also indicate the direction of tresulting current.



5- find the unknown quantites in the circuits shown below.



6- Using the voltage divider, find V_{ab} for the circuits shown below.

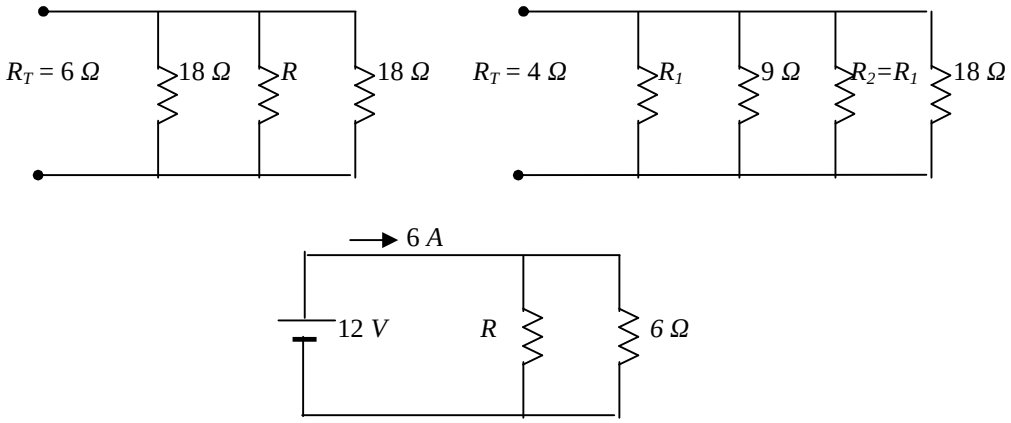


Electrical Engineering Fundamentals *EE-238*

Sheet 2

Parallel Circuits

1- Using the information provided find the unkonown resistances in the following circuts.

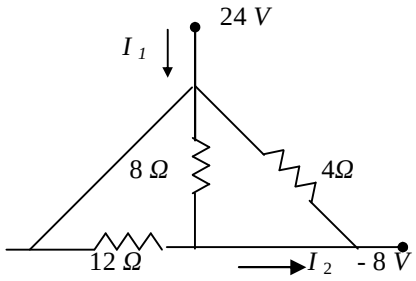


2- For the network shown:

a- Find the current *I*.

b- Calculate the power dissipated by 4 Ω resistor.

c- Find the current I_2..

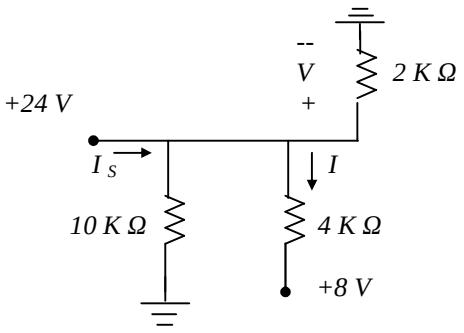


3- For the network shown:

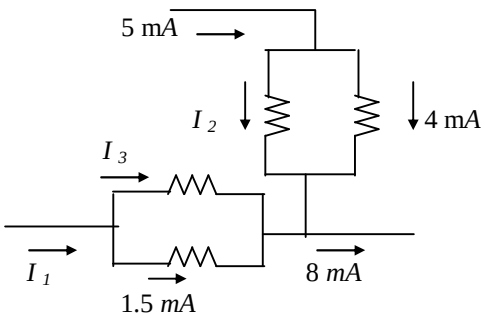
a- Find the current *I*.

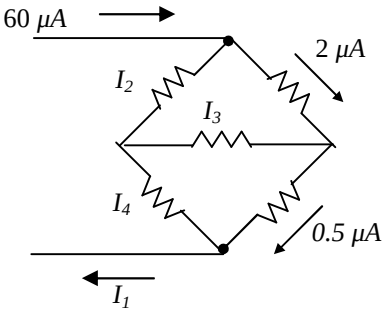
b- Find the voltage *V*.

c- Calculate the source current I_s.

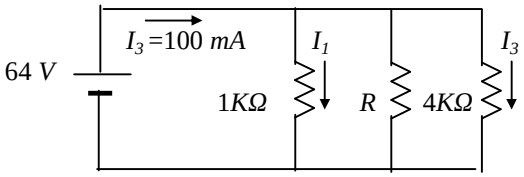


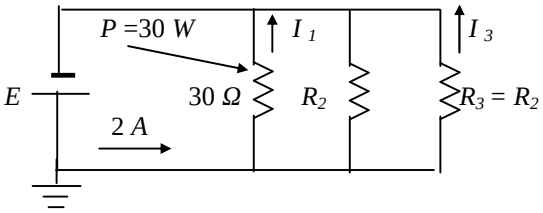
4- Using *Kirchhoff's* current law, determine the unknown current in the network shown below.



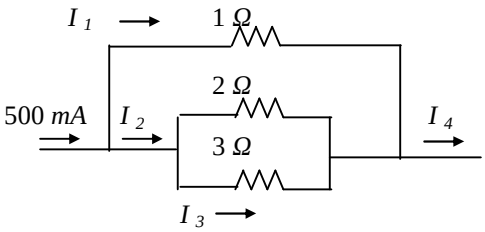


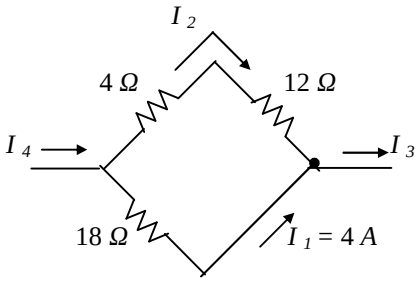
5- Find the unknown quantities for the circuits shown below.



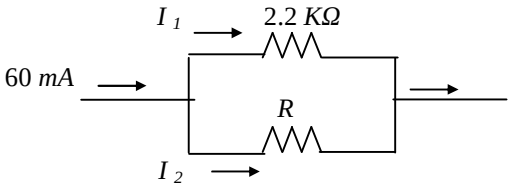


6- Using the current divider rule , find the unknown currents for the networks shown.



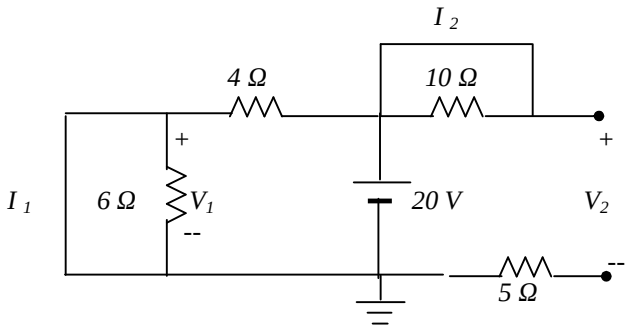


7- Calculate the resistor R for the network shown, that will ensure the current $I_1 = 3\ I_2$



8- For the network shown, determine:

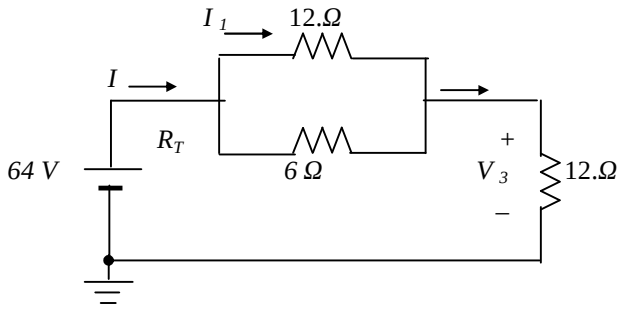
a- The short circuit currents I_1 and I_2.
b- *The voltages* V_1 and V_2.
c- The source current.



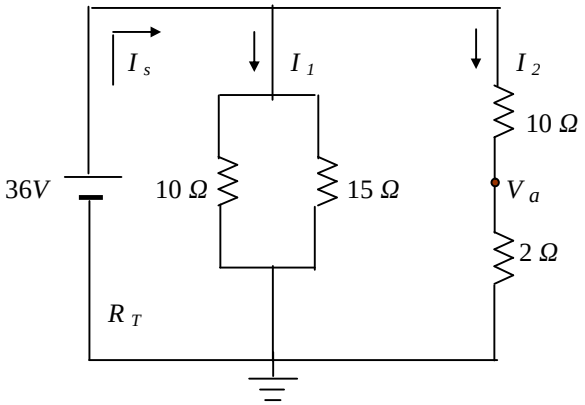
Electrical Engineering Fundamentals *EE-238*

Sheet 3
Series &Parallel Kirchhoff's Laws

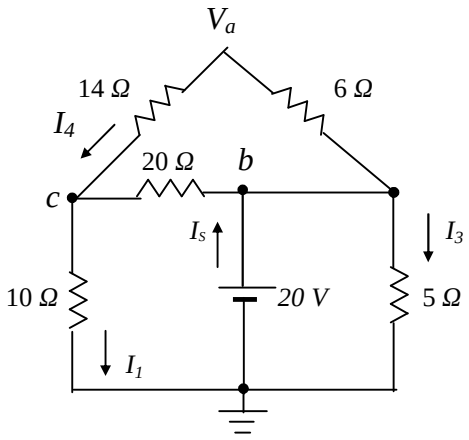
1- For the network shown:
- a- Calculate R_T.
- b- Determine I and I_1.
- c- Find V_1.



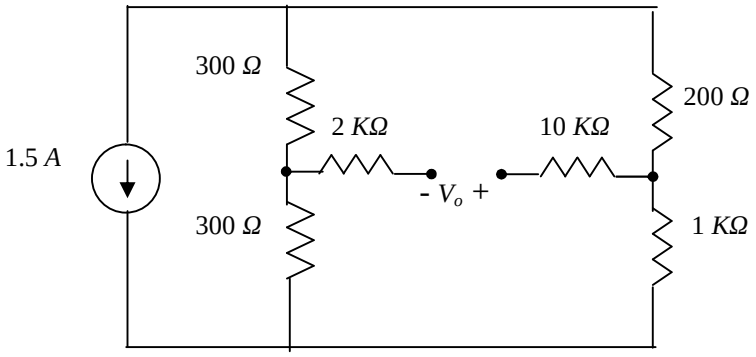
2- For the circuit shown:
- a- Determine R_T.
- b- Find I_s , I_1 and I_2.
- c- Calculate V_a.



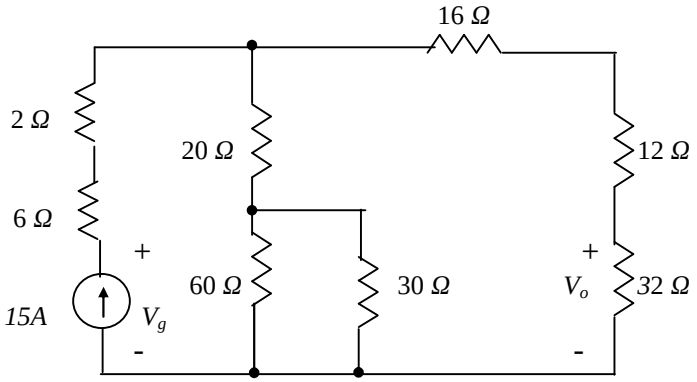
3- For the network shown:
- a- Determine the currents I_s, I_1, I_3 and I_4.
- b- Calculate the voltages V_a and V_{bc}.



4- Find V_o in the circuit shown.



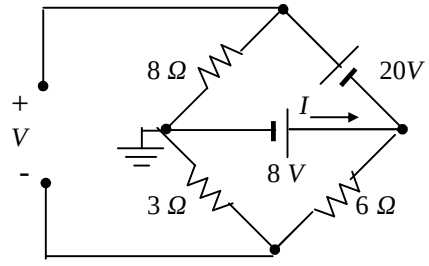
5- Find V_o and V_g in the circuit shown



6- For the network shown:

a- Determine the current I.

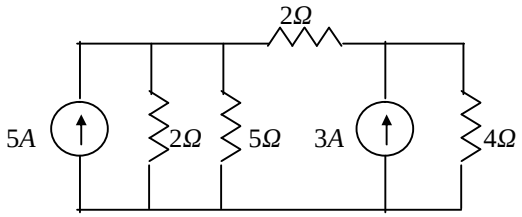
b- Calculate the open circuit voltage V.

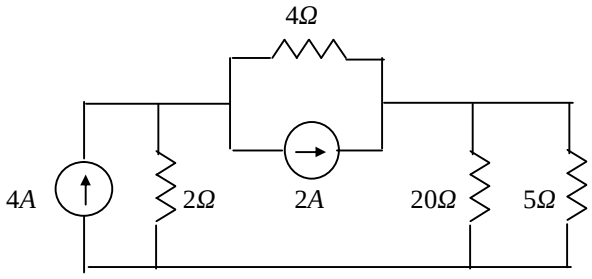


Electrical Engineering Fundamentals *EE-238*

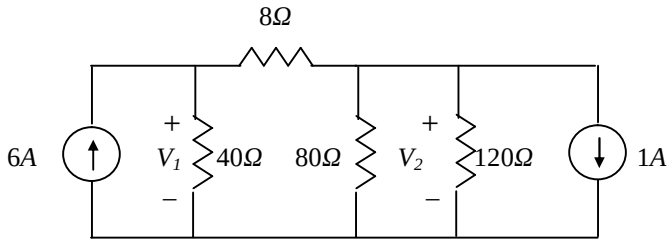
Sheet 4
Node Voltage Methode

1- Write the nodal equations of the networks shown below, then find the node voltages.

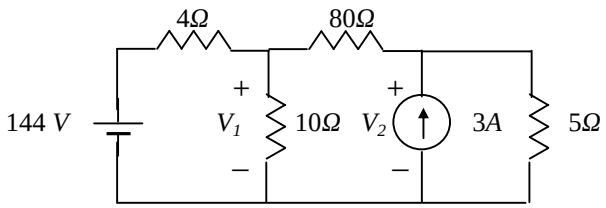




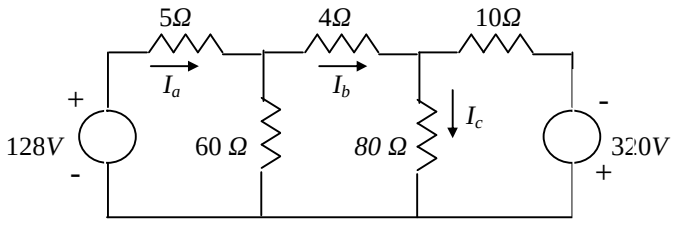
2- Use the node voltage methode to find the voltages V_1 and V_2 in the circuit shown.



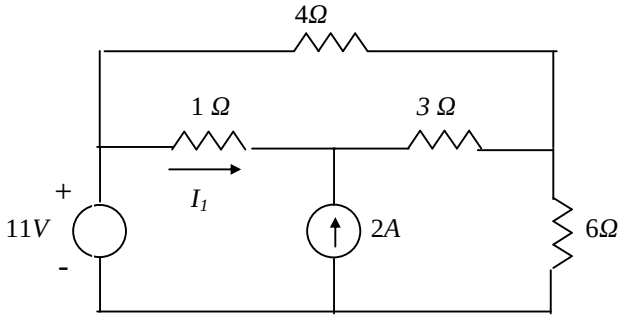
3- Use the node voltage methode to find the voltages V_1 and V_2 in the circuit shown.



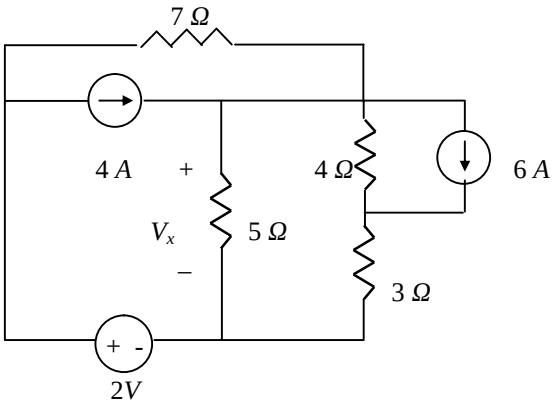
4- Use the node voltage methode to find the voltages I_a , I_b and I_c in the circuit shown.



5- Use the node voltage methode to find the voltages I_1 in the circuit shown.



6- Find the voltage V_x using the node voltage methode.



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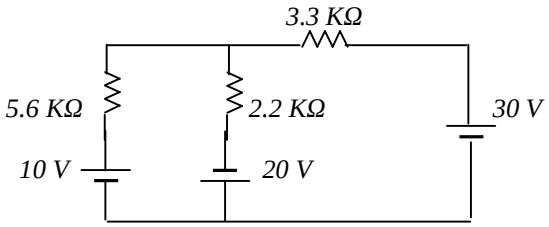
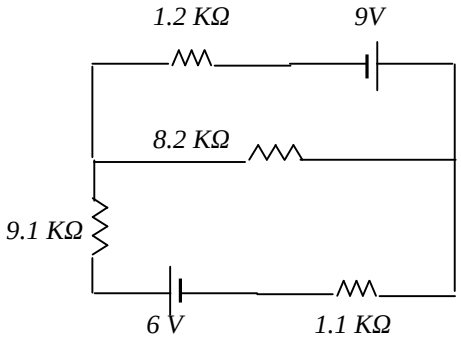
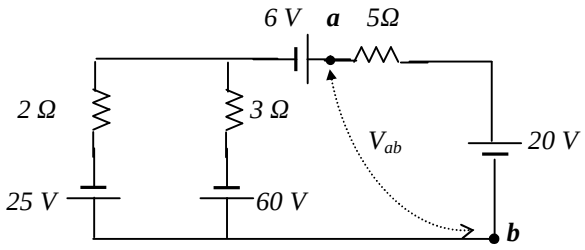
Sheet 5
Mesh Current Method

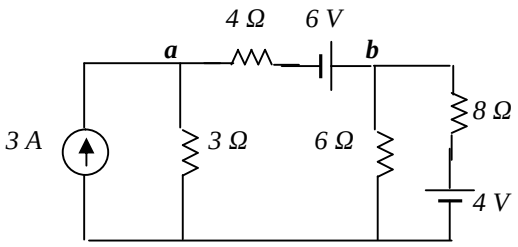
1- Find the current through each resistor using mesh current method.



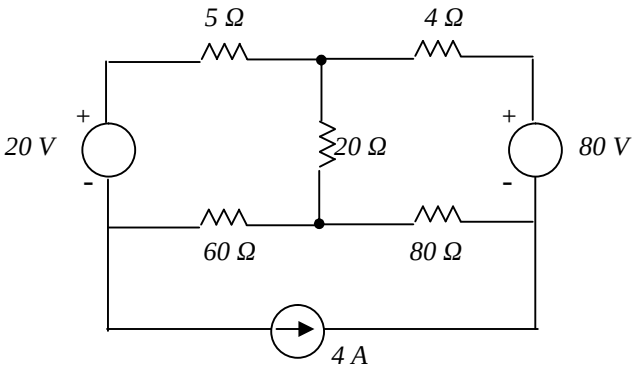


2- Using mesh current method find the voltages V_{ab} for the networks shown.

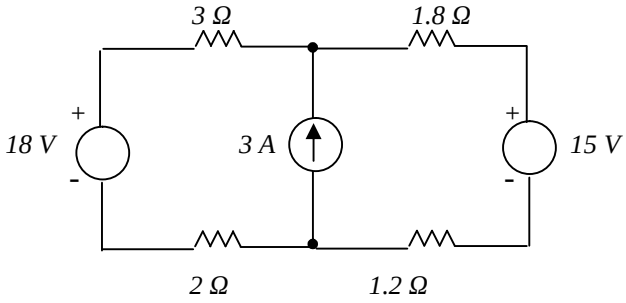




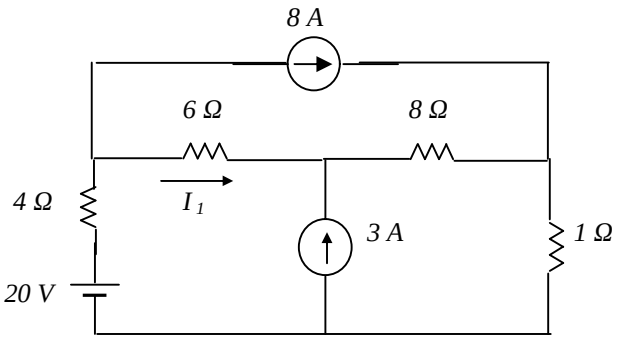
3- Use the mesh current method find the voltage across the 20 Ω resistors in the circuit.

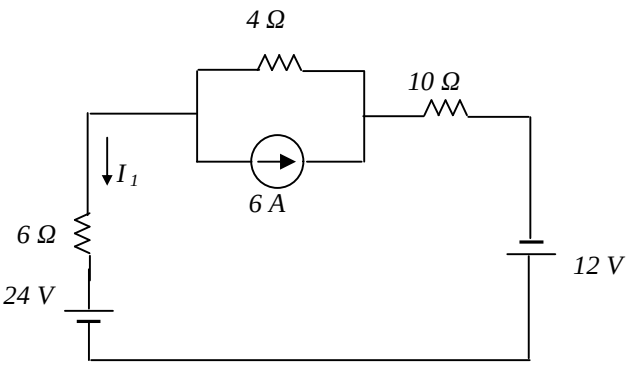


4- Use the mesh current method find the total power dissipated in the circuit.



5- Use the mesh current method find the current I_1 in the circuits.





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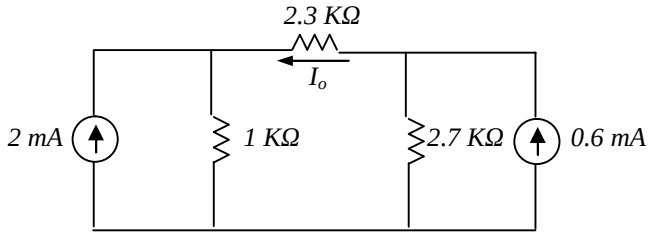
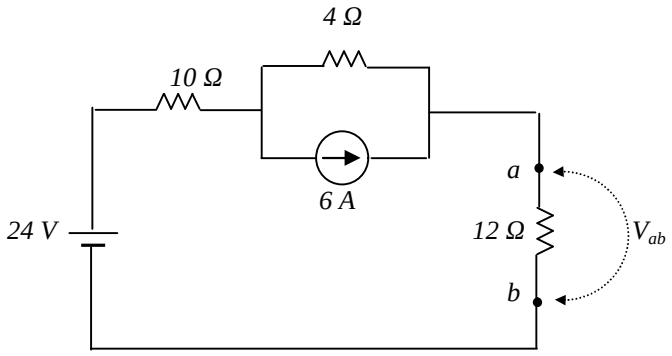
Sheet 6
Source Transformation & Superposition

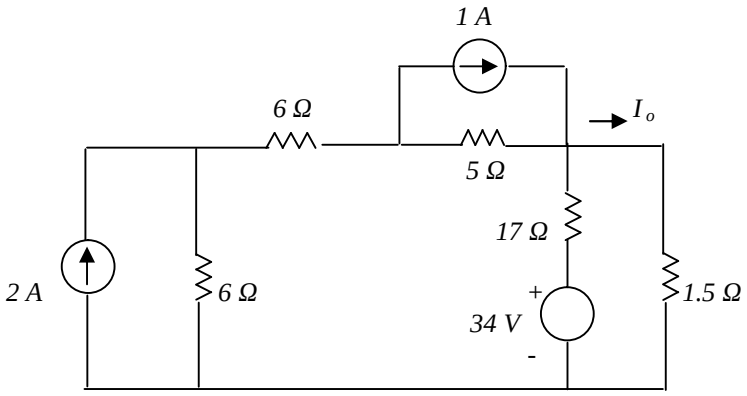
1-Using series of source transformation find I_o.



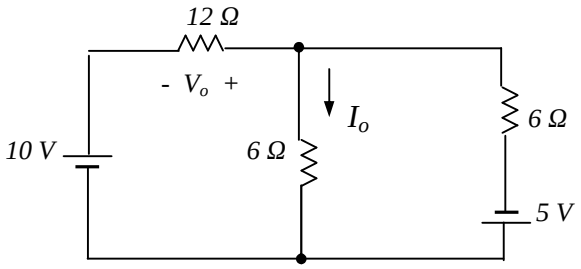
2- Using source transformation find V_{ab}.



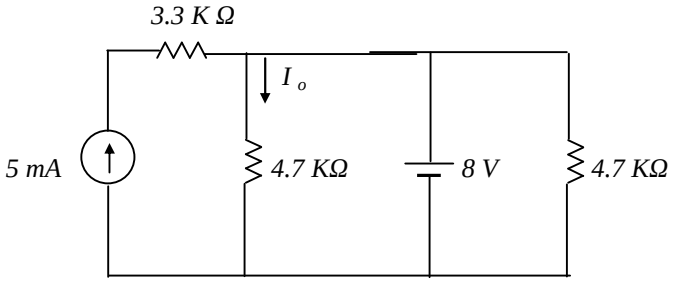
3- Using series of source transformation find I_o.

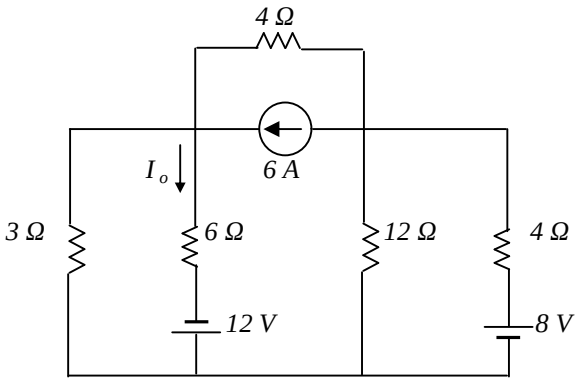


4- Using the principle of superposition find I_o.

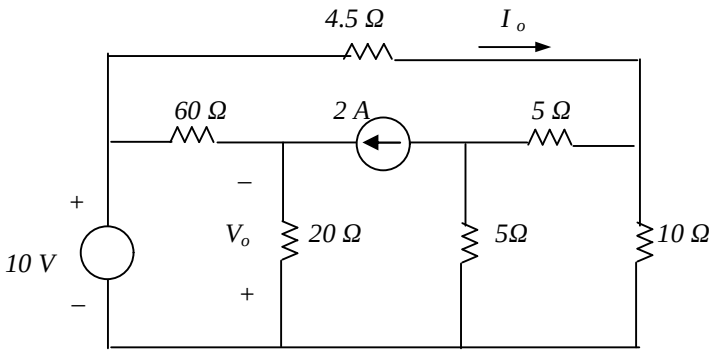


5- Using the principle of superposition find I_o.





6- Using the principle of superposition find I_o and V_o.



Sheet 7

Magnetic Circuits

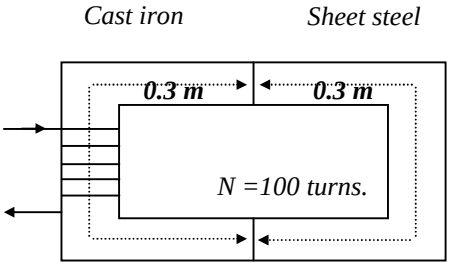
1- Find the current necessary to establish a flux $\Phi = 3x10^{-4}$ *Wb* in the series magnetic circuit shown in figure.

$L_{sheet\ steel} = 0.3$ *m.*

$L_{cast\ iron} = 0.3$ *m.*

Area (throughout) $= 5x10^{-4}\ m^2$.

N =100 turns.

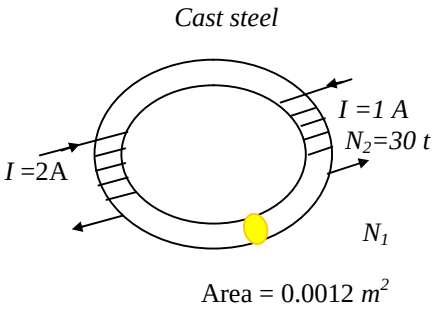


2- a- Find the number of turns *N* required to establish a flux $\Phi = 12x10^{-4}$ *Wb* in the magnetic circuit shown in figure.

b- Find the permeability of the material.

L_m = *mean length = 0.2 m.*

Uniform area (throughout) = $0.0012\ m^2$.



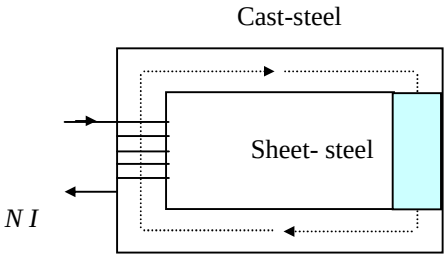
3- a -Find the *m.m.f.* *N I* required to establish a flux $\Phi = 80000$ *lines* in the magnetic circuit shown in figure.

b- Find the permeability of each material.

$L_{cast\ steel} = 5.5$ *inch.*

$L_{sheet\ steel} = 0.5$ *inch.*

Uniform area (throughout) $= 1\ inch^2$.



4- For the series magnetic circuit with two sources of magnetic pressure, determine the current *I*.

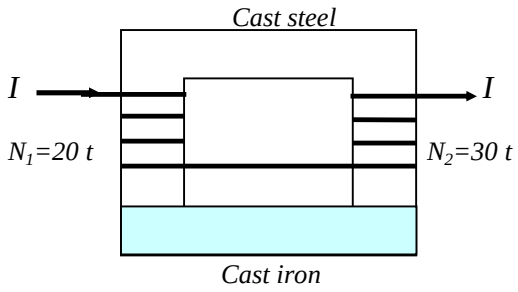
Each applied *m.m.f* establishes a flux in the opposite direction of the other.

$\Phi = 0.8x10^{-4}$ *Wb.*

$L_{cast\ steel} = 5.5$ *inch.*

$L_{cast\ iron} = 2.5$ *inch.*

Area (throughout) $= 0.25\ inch^2$.

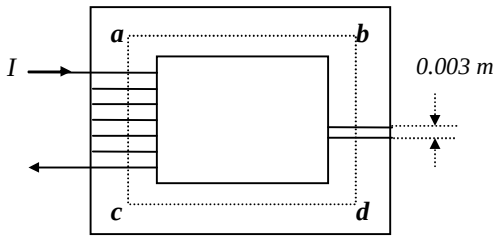


5- a -Find the current I required to establish a flux $\Phi = 2.4x10^{-4}\ Wb$ in the magnetic circuit shown in figure.

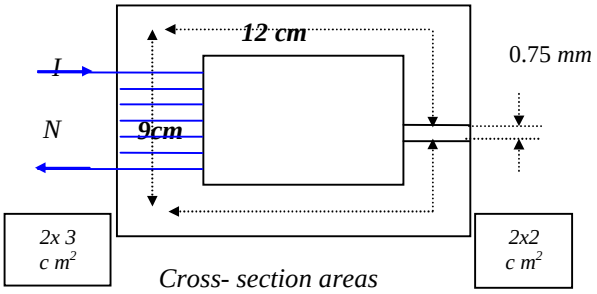
b- Compare the *mmf* drop across the air gap to that across the rest of the magnetic circuit. Discuss your results using the value of μ for each.

Area (throughout) $= 2\ x10^{-4}\ m^2$.

$N = 100$ Turns.
$l_{ab} = l_{cd} = 0.05$ m.
$l_{ac} = l_{bd} = 0.02$ m.



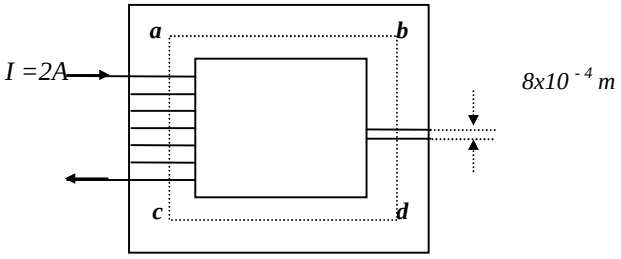
6- The magnetic circuit shown in figure is constructed of sheet steel, and the coil has 900 turns. Calculate the current I required to establish a flux $\Phi = 330\ \mu Wb$ in the air gap.



7- Determine the magnetic flux Φ established in the magnetic circuit shown in figure.

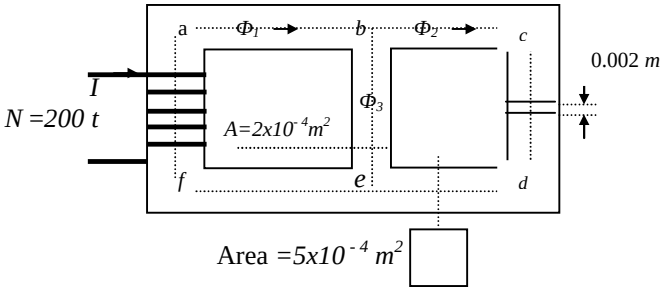
Area (throughout) $= 2\ x10^{-4}\ m^2$.

$l_{ab} = l_{cd} = 0.2$ m.
$l_{ac} = l_{bd} = 0.2$ m.
The air gap in $l_{cd} = 8x10^{-4}$ m.
$N = 150$ turns.
$\mu_r = 600$.



8- For the series - parallel magnetic circuit constructed of cast steel shown in figure, find the value of current I required to establish a flux in the air gap $\Phi = 1x10^{-4}\ Wb$.

$L_{ab} = L_{bc} = L_{fe} = L_{ed} = 0.2$ m.
$L_{af} = L_{be} = L_{cd} = 0.1$ m.



Sheet 8
Alternating Current

1- Convert the following:

- Degrees to radians 45^o, 120^o,178^o, and 221^o
- Radians to degrees $\pi / 8$, 3π, 0.55π and $0.1\pi / 4$

2- Find the angular velocity $\boldsymbol{\omega}$ of the waveforms with:

- Period T 2 sec,. 0.3 m sec, 4 μ sec and 1 / 25 sec.
- Frequency f 50 Hz, 600 Hz, 2 KHz, and 0.004 MHz.

3- Find the frequency f and the period T of sin waves having the angular velocity $\boldsymbol{\omega}$:

754 rad/sec, 8.4 rad/sec, 6000 rad/sec and 1/16 rad/sec**.**

4- A sinusoidal waveform:

- Passes through an angle of 30^o in 5 msec, determine the angular velocity $\boldsymbol{\omega}$.
- If the frequency is $f = 50$ Hz, determine the time it will take to pass an angle 45^o.

5- Find amplitude and frequency of the following waveforms:

- $20 \sin 377t$, $5 \sin 754t$, $10 \sin 10000t$, $0.001 \sin 9421t$ and $7.6 \sin 43.6t$.

6- Sketch the wave $5 \sin 754t$ with abscissa:

- Angle in degrees, angle in radians and time in seconds.

7- Determine the time t for the given α in the following:

- $V = 0.5 \sin \alpha t$ ($\alpha = 72^o$) and $V = 20 \sin \alpha t$ ($\alpha = 1.2\pi$).

8- Given $V = 30 \times 10^{-2} \sin \alpha$, determine the angle α when $V = 6$ mV.

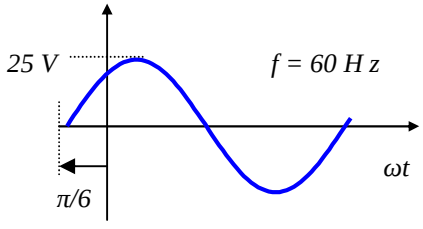
9- If $V = 40$ v at $\alpha = 30^o$ and $t = 1$ m sec., write the mathematical expression of the sinusoidal voltage.

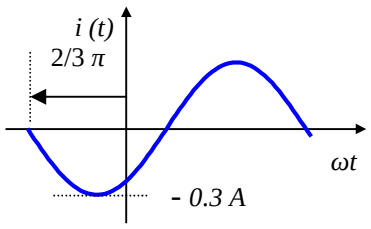
10- Sketch the waves $50 \sin(\omega t + 0^o)$, $5 \sin(\omega t \pm 60^o)$ and $50 \cos(\omega t)$.

11- Find the phase relation of between:

- $v(t) = 40 \sin(\omega t + 50^o)$ and $i(t) = 5 \sin(\omega t + 40^o)$
- $v(t) = 0.2 \sin(\omega t - 80^o)$ and $i(t) = 0.1 \sin(\omega t - 10^o)$
- $v(t) = 20 \cos(\omega t - 30^o)$ and $i(t) = 5 \sin(\omega t + 60^o)$

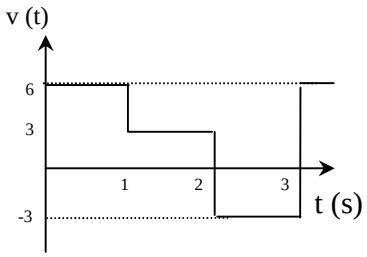
12- Write the analytical expression for the waveform given in figure.

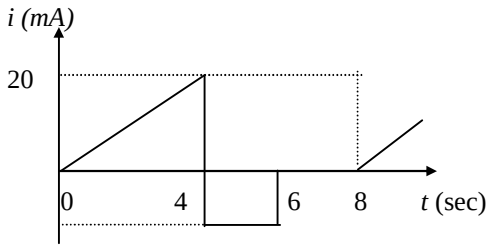




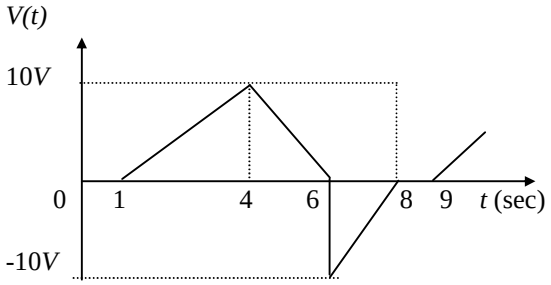
Sheet 9
Average & Effective Value

1- Find the average values of the waveforms shown in figure over one cycle.





2- Find the average value of the waveforms shown in figure over one cycle.



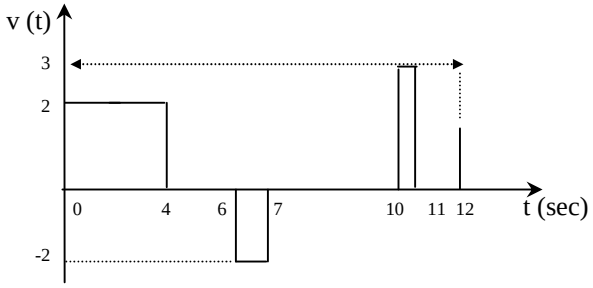
3- Find the effective value of the following sinusoidal waveforms:

- $v(t)=20 \sin 754\, t$ $\quad v(t)= 7.07 \sin 377\, t$
- $i(t) =0.006 \sin (400\, t+20^{o})$ $\quad i(t) =16\times10^{-3} \sin (377\, t-10^{o})$

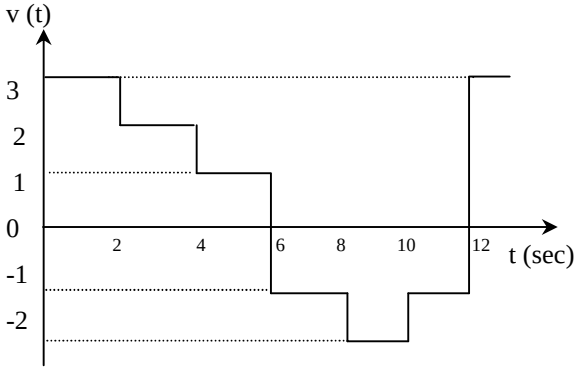
4- Write the sinusoidal expressions for voltages and currents having the following effective values at a frequency of 60 c/sec with zero phase shift:

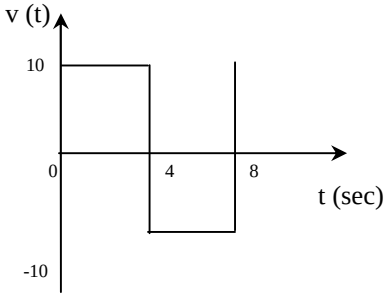
- 1.414 volt 70.7 volt 0.06 A 24 µA

5- Find the effective value of the wave form shown in figure over one cycle.

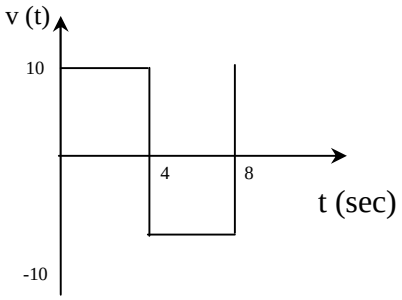


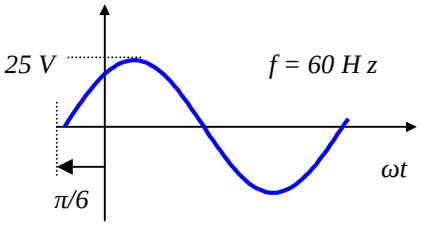
6- Find the effective value of the wave forms shown in figure over one cycle.

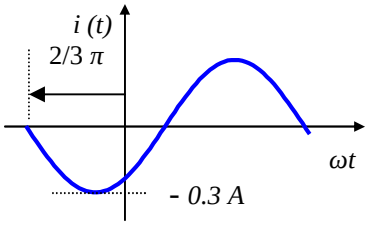




7- Find the effective and average values of the square waveform of figure over one cycle.







Sheet 10
Phasors

1- Express the following phasor currents and voltages as sin waves if the frequency is *f = 50 c/sec*:

a) I = 40 A $\angle 20^o$ b) V = 120 v $\angle 0^o$

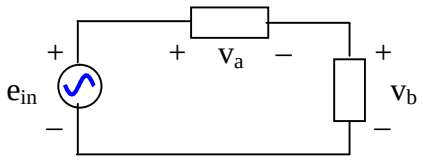
c) I = 8 x10^3 A $\angle 120^o$ d) V = 5 v $\angle 90^o$

e) I = 1200 A $\angle -120^o$ f) V = $\frac{6000}{\sqrt{2}}$ v $\angle -180^o$

2- For the circuit shown in figure, find the sinusoidal expression for the unknown voltage v_a if:

e_{in}= 60 sin (377t + 20^o)

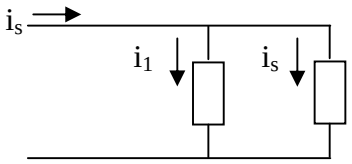
v_b= 20 sin (377t)



3- For the circuit shown in figure, find the sinusoidal expression for the unknown current i_s if:

i_1= 20x10^6 sin (ωt + 90^o)

i_2= 20x10^6 sin (ωt - 60^o)

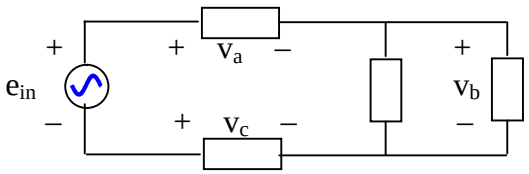


4- Find the sinusoidal expression for the unknown voltage e_{in} if:

v_a= 60 sin (ωt + 30^o)

v_b= 30 sin (ωt - 30^o)

v_c= 40 sin (ωt + 120^o)

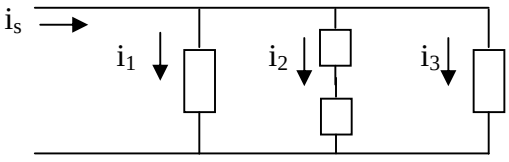


5- For the circuit shown in figure, find the sinusoidal expression for the unknown current i_s if:

i_1 = 6x10^3 sin (377t + 180^o)

i_2 = 8x10^3 sin (377t)

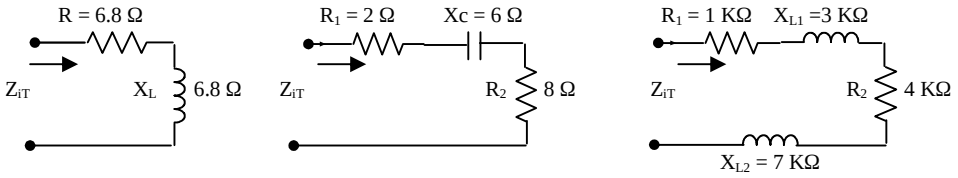
i_3 = 2 i_2



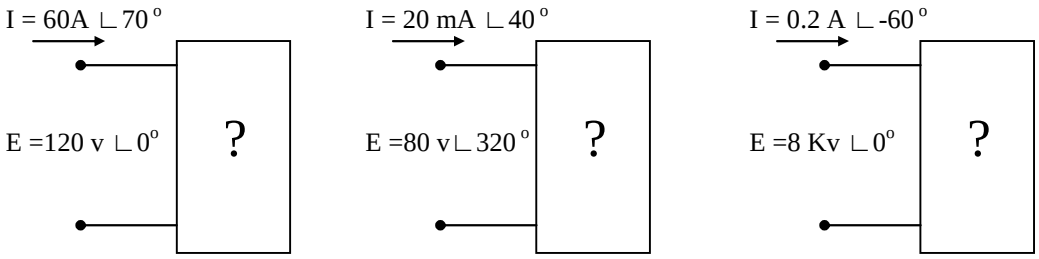
Sheet 11

Series Configuration

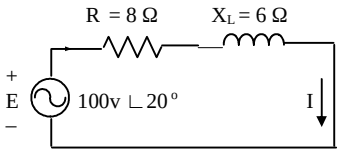
1- Calculate the total impedance of the circuit shown in figure. Express your answer in Rectangular and polar form, and draw the impedance diagram.



2- Find the type and impedance in Ohms of the series circuit elements that must be contained in the closed containers shown in figure for the indicated voltages and currents at the input terminals. Find the simplest series circuits that satisfy the indicated conditions



3- For the circuit shown in figure:



a- Find the total impedance Z in polar form.

b- Draw the impedance diagram.

c- Find the current I and the voltages V_R and V_L in polar form.

d- Draw the phasor of voltages V, V and V and the current I.

e- Verify Kirchhoff's voltage law around the closed loop.

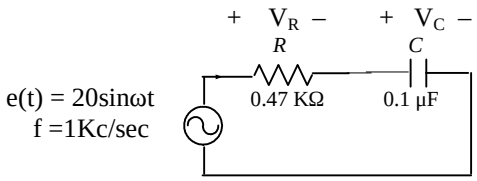
f- Find the average power delivered to the circuit.

g- Find the power factor of the circuit and indicate whether it is leading or lagging.

h- Find the sinusoidal expressions for the voltages and current if *f = 60 c/sec*.

i- Plot the waveforms for the voltages and current on the same set of axes.

4- Given the network shown in figure:



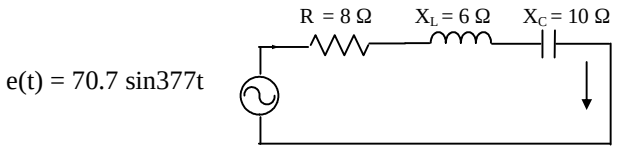
a- Determine Z_{iT}

b- Find I.

c- Calculate V_R and V_L

d- Find P and p.f.

5- For the circuit shown in figure:



a- Find the total impedance Z in polar form.

b- Draw the impedance diagram.

c- Find the value of C in μF and the value of L in Henry.

d- Find the current I and the voltages V_R ,V_L and V_C in polar form.

e- Draw the phasor diagram of voltages V_R ,V_L and V_C and the current I.

f- Verify Kirchhoff's voltage law around the closed loop.

g- Find the average power delivered to the circuit.

h- Find the power factor of the circuit and indicate whether it is leading or lagging.

i- Find the sinusoidal expressions for the voltages and current.

j- Plot the waveforms for the voltages and current on the same set of axes.