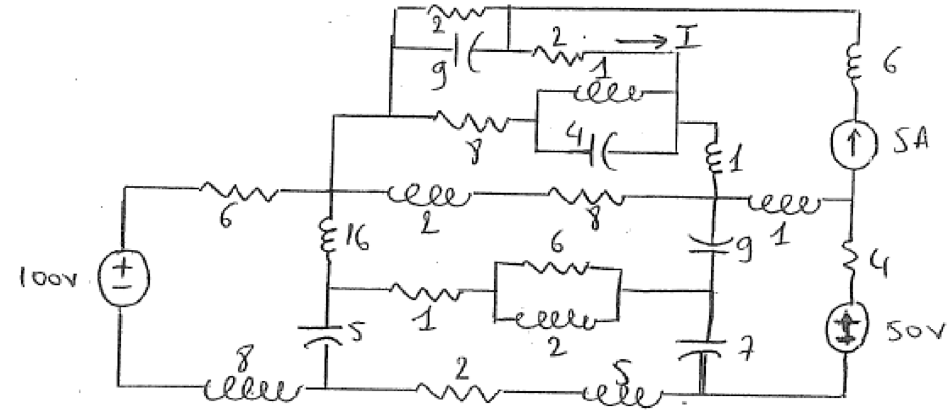
25.Consider the circuit below, connected for a long time. All resistors are in Ohm,capacitors in Farads and inductors in Henrys. Find the current I.



a)5.357A b)11.25A c)7.5A d)22.5A e)NOA

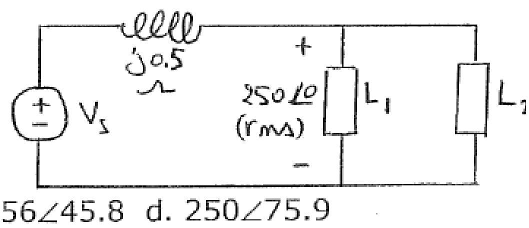
-1- Two inductive loads of 0.88 KW and 1.32 KW at power factors of 0.8 and 0.6 respectively are connected in parallel across a 220-V (rms), 50Hz supply. Calculate the total current taken by this combination.

a. 1A b. 14.86A c. 10.86A d. 15.45A e. None of the above

-2- For the previous problem, find the value of capacitance in microfarads, to be connected in parallel with the loads to bring the combined power factor to 0.9 lagging.

a. 89 b. 35.8 c. 25.6 d. 44.5 e. None of the above

-4- Find the $V_{S\ (rms)}$ in this circuit if loads L1 and L2 are 13KVA at 0.8pf lagging and 10KVA at 0.96 pf leading,respectively.



a. 120∠36 b. 263∠8.75 c. 342.56∠45.8 d. 250∠75.9

-6- Two impedances Z=(2+j4) Ω and Z′=R Ω are connected in parallel. Find R so that the power factor of the circuit is 0.9 lag.

a. 1.3Ω b. 3.2Ω c. 2.4Ω d. 3Ω e. None of the above

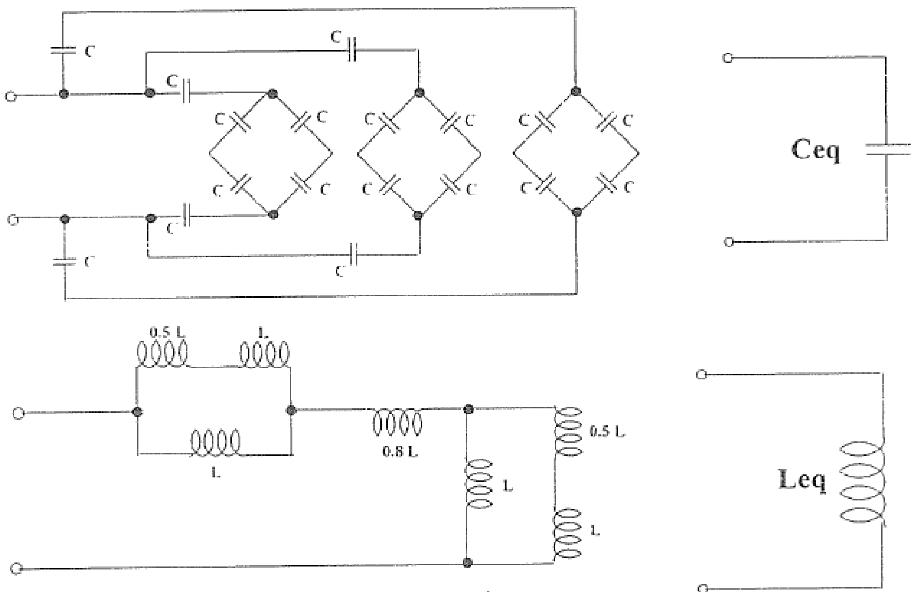


Figure 4

5. Find C_{eq} and L_{eq} for the networks shown in figure 4.

a) $C_{eq} = C; L_{eq} = 2L$

b) $C_{eq} = 0.5C; L_{eq} = 2L$

c) $C_{eq} = 2C; L_{eq} = L$

d) $C_{eq} = C; L_{eq} = 0.5L$

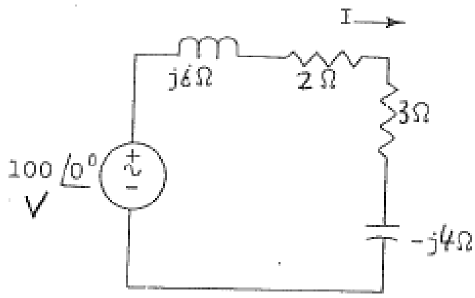


Figure 4.

4. Find the current in the circuit shown in figure 4.

A. 18.6 /-21.8° A
B. 22.5 /-35.6° A
C. 12.3 /-18.9° A
D. 34.7 /-29.7° A
E. None of the above

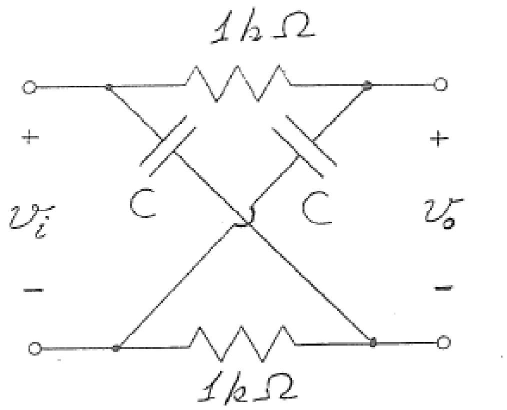


Figure 9.

9. Determine C in the circuit shown in figure 9 so that the output voltage v_o has the same magnitude as the input voltage v_i but lags it by 90°, assuming ω = 200 rad/s.

A. 5 μF
B. 2 μF
C. 6 μF
D. 8 μF
E. None of the above

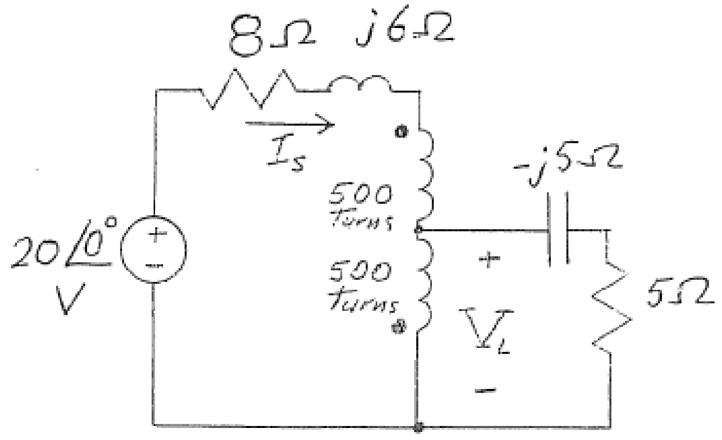


Figure 12.

12. Determine $\mathbf{I}_s$ and $\mathbf{V}_L$ in the circuit shown in figure 12.

A. $1.4\angle-45.0°$ A, 0 V
B. $0.7\angle-45.0°$ A, $0.3\angle45.0°$ V
C. $1.4\angle-36.3°$ A, $0.3\angle14.4°$ V
D. $1.1\angle-45.0°$ A, $0.4\angle45.0°$ V
E. None of the above $2\angle-36.9$ A, 0 V

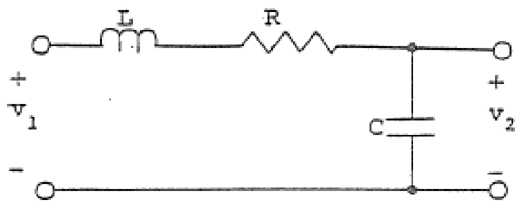


Figure 3.

4. The voltage ratio $V_2(s) / V_1(s)$ in Fig. 3 has a pole at $-100 + j700$ rad/s. If R = 500 ohms, find L and C.

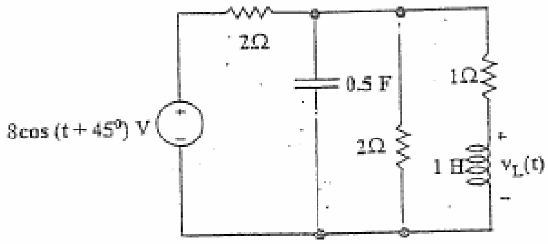
A. L = 1.5 H, C = 1.388 μF
B. L = 1.0 H, C = 2.083 μF
C. L = 2.5 H, C = 0.800 μF
D. L = 2.0 H, C = 1.040 μF
E. None of the above

2. Determine the power factor associated with a load that consists of a 6.25 μF capacitor in parallel with the series combination of a 400 ohms resistance and a 1 H inductance at ω = 400 rad/s.

A. 0.922 lagging
B. 0.806 leading
C. 0.632 lagging
— D. 0.707 leading
E. None of the above

4. Find the expression of $v_L(t)$ in the circuit shown in Fig. 3.

— A. $v_L(t) = 1.89\cos(t + 90°)$ V
B. $v_L(t) = 1.24\cos(t - 90°)$ V
C. $v_L(t) = 2.58\cos(t + 45°)$ V
D. $v_L(t) = 0.96\cos(t - 45°)$ V
E. None of the above



6. Find v_o in the circuit shown in Fig. 5 if ω = 5 x 10^6 rad/s.

A. 14.7 /21.8° V
B. 11.6 /15.6° V
C. 12.8 /35.2° V
D. 10.5 /25.9° V
E. None of the above

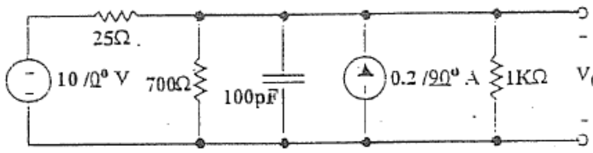
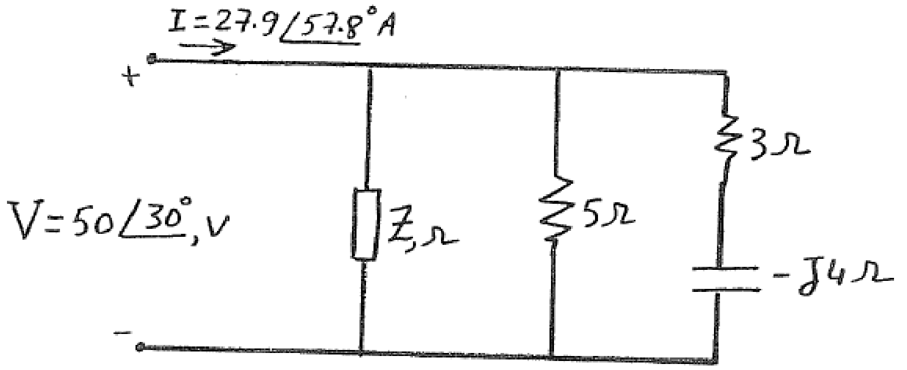


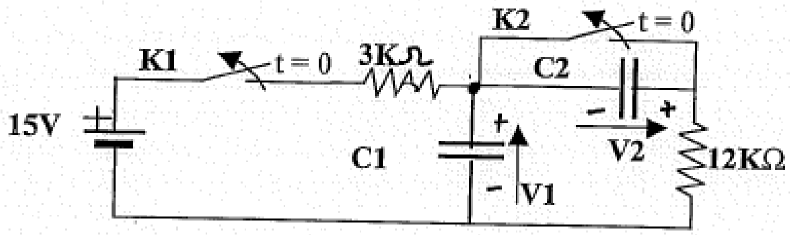
Figure 5.

12. Determine Z in the circuit shown below:



A. 0.2 <29.9°Ω
B. 5Ω
C. 5<-29.9°Ω
D. 1.8<-27.8°Ω
E. None of the above.

2. Consider the circuit below. Switches K1 and K2 open at t = 0, after being closed for a long time. Find final values of voltages V1 and V2 respectively across C1 and C2. C1= 1μF, C2= 2μF



a) V1= +4V, V2= -4V
b) V1= +6V, V2= -6V
c) V1= +8V, V2= -8V
d) V1= 0V, V2= 0V
e) None of the above

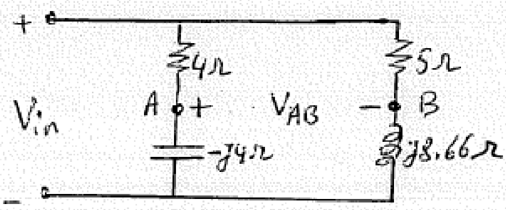
1. A coil (R and L) has a resistance of 10Ω and draws a current of 5A (RMS) when connected across a 100V (RMS), 60 Hz source. Determine the inductance of the coil.

a. 17.32 mH
b. 32.48 mH
c. 45.94 mH
d. 102.73 mH
e. None of the above

2. In problem 1, find the power factor angle of the circuit.

a. 30.1
b. 60
c. 45
d. 75.52
e. None of the above

3. In the circuit shown, V_{AB} =48.3<30 V. Find V_{in}

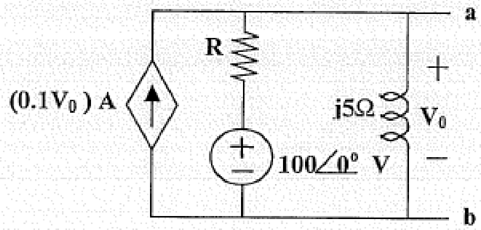


a. 50<135 V
b. 36<45 V
c. 80<135 V
d. 73<45 V
e. None of the above

4. Two impedances Z1=2+j4, Ω and Z2=R, Ω are connected in parallel. Determine R so that the power factor of the circuit is 0.9 lagging.

a. ~6.23Ω
b. ~5.3Ω
c. ~1.59Ω
d.~3.2Ω
e. None of the above

11. Considering the circuit below find its Thevenin impedance between a and b.

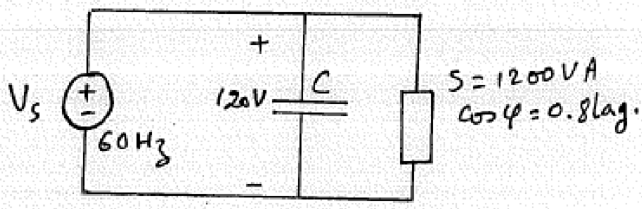


R= 2Ω

a) (2 + j1)Ω
b) (2 + j4)Ω
c) (j5)Ω
d) (j2)Ω
e. None of the above

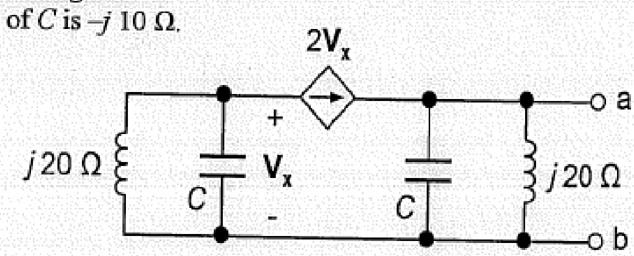
3. A single phase source of voltage, of frequency 60Hz, is supplying a load of 1200VA at a power factor of 0.8 lagging. A capacitor C=130μF is connected in parallel to the load and the RMS voltage across it is 120V. Find the real component of the current delivered by the source.

a) 8 A
b) 7 A
c) 6 A
d) 5 A
e) None of the above



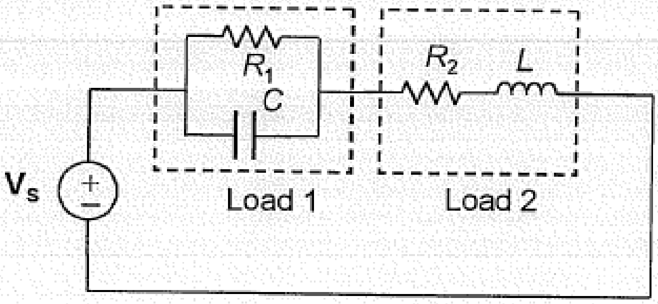
19. Determine Thevenin's impedance looking into terminals ab, given the reactance of C is $-j$ 10 Ω.

A. $-j$ 20 Ω
B. $+j$ 20 Ω
C. $-j$ 40 Ω
D. $+j$ 40 Ω
E. None of the above



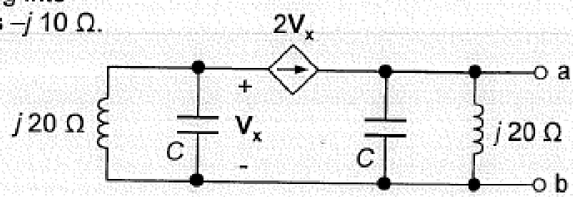
21. The values of R_1, R_2, C and L are unknown. Load 1 absorbs a complex power of $50\angle-45^\circ$ VA and Load 2 absorbs a complex power of $100\angle+45^\circ$ VA. Determine R_2 if $\mathbf{V_S} = 125\angle 0^\circ$ V.

A. $250\sqrt{2}\ \Omega$
B. $125\sqrt{2}\ \Omega$
C. $125\ \Omega$
D. $125/\sqrt{2}\ \Omega$
E. None of the above



1. Determine Thevenin's impedance looking into terminals ab, given the reactance of C is $-j\ 10\ \Omega$.

A. $-j\ 20\ \Omega$
B. $+j\ 20\ \Omega$
C. $-j\ 40\ \Omega$
D. $+j\ 40\ \Omega$
E. None of the above

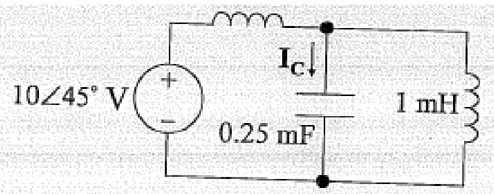


2. Determine $\mathbf{I_C}$, given that $\omega = 2$ krad/s

A. $5\angle 135^\circ$ A B. $10\angle 45^\circ$ A

C. $5\angle -45^\circ$ A D. $10\angle 90^\circ$

E. None of the above



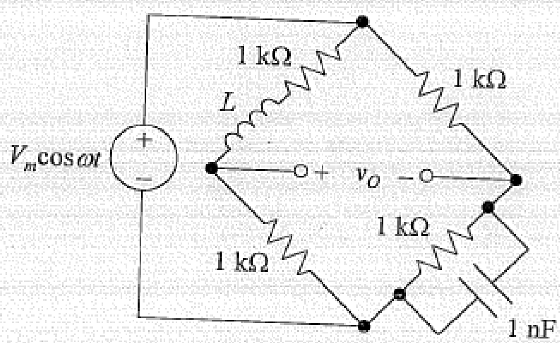
Solution: $j\omega L = j2\times10^{3}\times10^{-3} = j2\ \Omega;\ \dfrac{1}{j\omega C} = \dfrac{1}{j2\times10^{3}\times0.25\times10^{-3}} = -j2\ \Omega.$

The parallel impedance of $j2\ \Omega$ and $-j2\ \Omega$ is infinite, so that no current flows in the 4 mH inductor. The voltage across the capacitor is $10\angle45^\circ$ V, and $\mathbf{I_C} = \dfrac{10\angle45^\circ}{-j2} = 5\angle135^\circ$ A.

8%

6. Determine L so that the bridge is balanced ($v_O = 0$) at $\omega = 10^6$ rad/s.

A. 1 mH
B. 2 μH
C. 4 μH
D. 1 H
E. None of the above



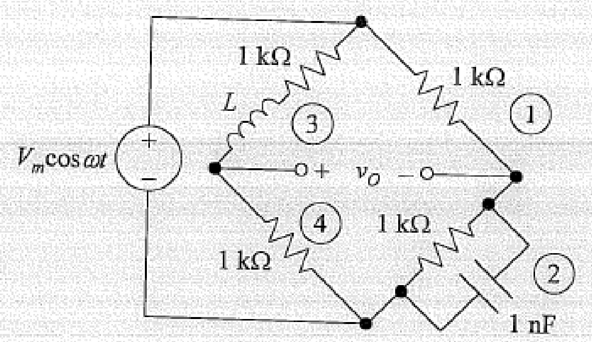
Solution:: At balance, $\frac{Z_1}{Z_2} = \frac{Z_3}{Z_4}$;

$Z_2 = \frac{R / j\omega C}{R + 1/j\omega C} = \frac{R}{1 + j\omega CR}$; Ω.

$\frac{Z_1}{Z_2} = 1 + j\omega CR$. Hence. $\frac{R + j\omega L}{R} =$

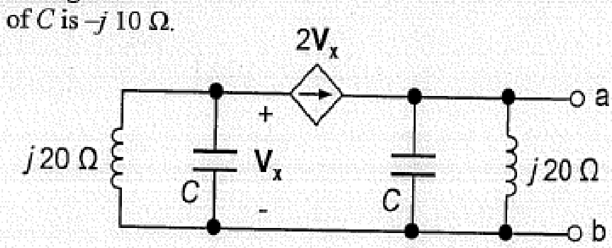
$1 + \frac{j\omega L}{R} = 1 + j\omega CR$, or

$L = CR^2 = 10^{-9} \times 10^6 \equiv 1$ mH.



19. Determine Thevenin's impedance looking into terminals ab, given the reactance of C is $-j$ 10 Ω.

A. $-j$ 20 Ω
B. $+j$ 20 Ω
C. $-j$ 40 Ω
D. $+j$ 40 Ω
E. None of the above



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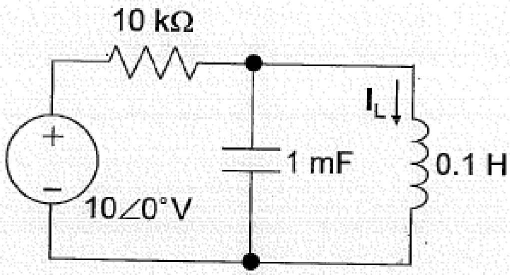
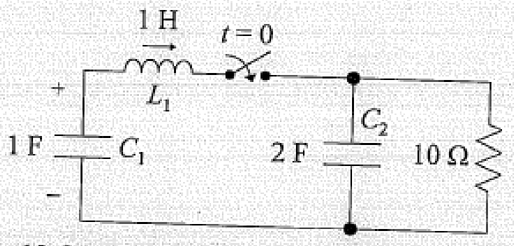
5. Determine $\mathbf{I}_L$, given that ω = 100 rad/s.



A. zero
B. infinite
C. 1∠90° A
— D. 1∠ − 90° A
E. None of the above

8%

1. C_1 has an initial voltage of 6 V and L_1 an initial current of 4 A, both in the polarity indicated. C_2 has no initial stored energy. If the switch is closed at $t = 0$, determine the energy dissipated in the 10 Ω resistor from $t = 0$ to infinity.

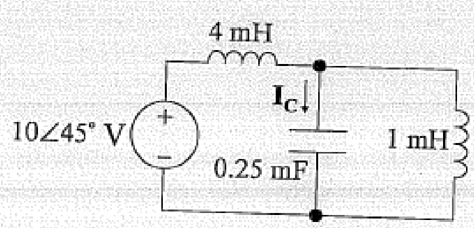


A. 12 J B. 26 J C. 60 J D. 84 J E. None of the above

Solution: The total energy dissipated in the resistor is that initially stored in C_1 and L_1, which is $0.5\times1\times(6)^2 + 0.5\times1\times(4)^2 = 26$ J.

8%

2. Determine $\mathbf{I}_C$, given that ω = 2 krad/s



A. 5∠135° A B. 10∠45° A

C. 5∠ − 45° A D. 10∠90°

E. None of the above

Solution: $j\omega L = j2\times10^3\times10^{-3} = j2\ \Omega;\ \frac{1}{j\omega C} = \frac{1}{j2\times10^3\times0.25\times10^{-3}} = -j2\ \Omega.$

The parallel impedance of $j2$ Ω and $-j2$ Ω is infinite, so that no current flows in the 4 mH inductor. The voltage across the capacitor is 10∠45° V, and $\mathbf{I}_C = \frac{10\angle45°}{-j2} = 5\angle135°$ A.

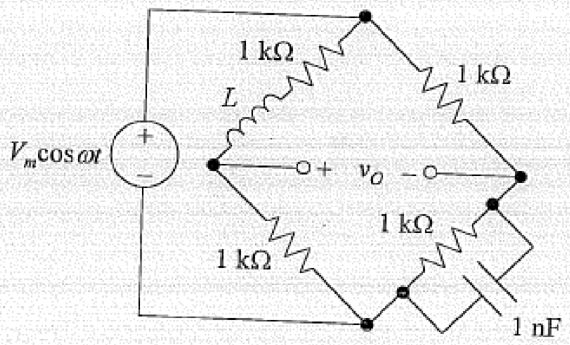
8%

6. Determine L so that the bridge is balanced ($v_O = 0$) at $\omega = 10^6$ rad/s.

A. 1 mH　　B. 2 μH

C. 4 μH　　D. 1 H

E. None of the above



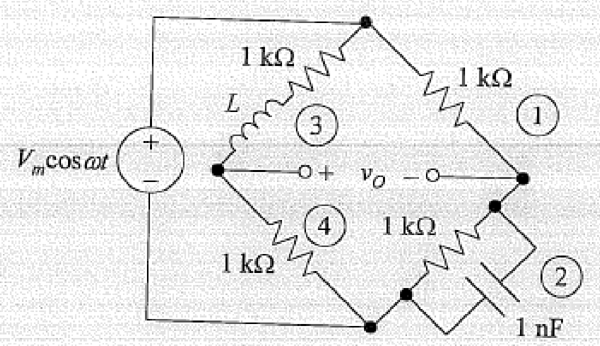
Solution:: At balance, $\frac{Z_1}{Z_2} = \frac{Z_3}{Z_4}$;

$$Z_2 = \frac{R / j\omega C}{R + 1/j\omega C} = \frac{R}{1 + j\omega CR}; \Omega.$$

$$\frac{Z_1}{Z_2} = 1 + j\omega CR. \text{ Hence. } \frac{R + j\omega L}{R} =$$

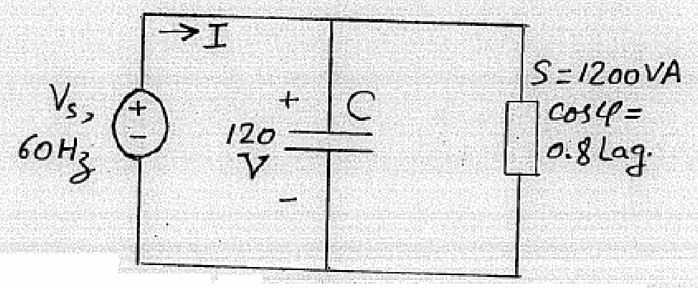
$$1 + \frac{j\omega L}{R} = 1 + j\omega CR, \text{ or}$$

$$L = CR^2 = 10^{-9} \times 10^6 \equiv 1 \text{ mH}.$$

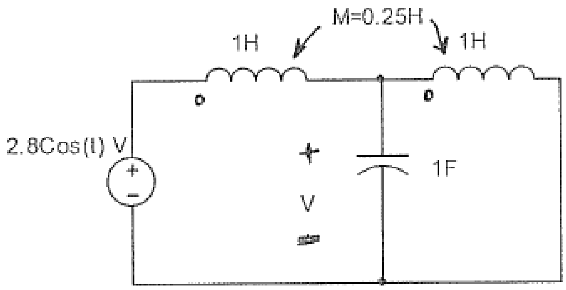


2. A single phase source of voltage, of frequency 60 Hz, is supplying a load of 1200 VA at a power factor of 0.8 lagging. A capacitor C=120 μF is connected in parallel to the load and the phasor voltage across it is 120 V (RMS). Find the real component of the current delivered by the source.

a. 0.8A
b. 6 A
c. 0.6 A
d. 8 A
e. None of the above



-7- Find the voltage across the capacitor of the circuit shown.



a. Cos(2.26t)   b. 0   c. 2.26Cos(t)   d. 0.25Cos(t)
f. None of the above

2. When a coil of a magnetically coupled pair has a current 5A, the resulting fluxes ϕ_{11} and ϕ_{22} are 0.2 and 0.4 mwb respectively. If the turns are 500 and 1500, find L_1 and L_2.

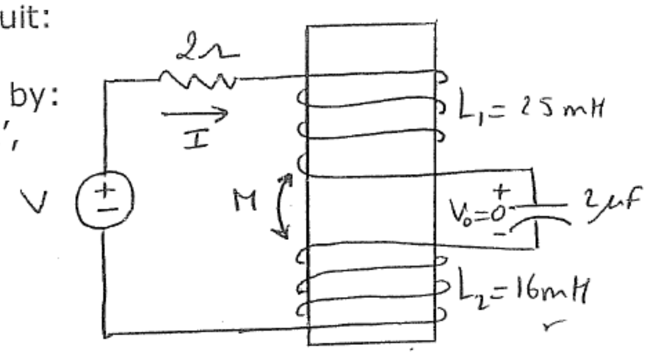
a) L_1 =60mH , L_2 =40mH → c) L_1 =60mH , L_2 =540mH
b) L_1 =40mH , L_2 =60mH   d) L_1 =120mH , L_2 =540mH
e)None of the above

Assuming $\frac{L_1}{L_2} = \left(\frac{N_1}{N_2}\right)^2$ which is not strictly correct because of leakage flux

3. For the given of problem2, find the mutual inductance and the coupling coefficient.

a)M=120mH, K=0.4   b)M=81.6mH, K=0.67
→ c)M=120mH, K=0.67   d)M=200mH , K=0.9
e)None of the above

4.Given the following circuit:
V=20Cos(200t), K=0.2
If the current I is given by:
I=a.Sin(200t)+b.I″+c.I′,
find a.b.c

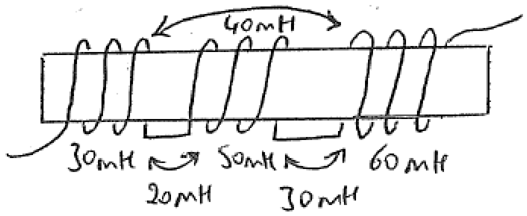


→ a) -237×10^{-17}
b) -256×10^{-17}
c) 128×10^{-16}
d) -128×10^{-16}
e) None of the above

5.Two coupled coils have self inductances L_1=50mH and L_2=200mH and the coefficient of coupling K=0.5. If coil 2 has 1000 turns, and i_1=5.Sin(400t), find the voltage at coil 2 and the flux ϕ_1.

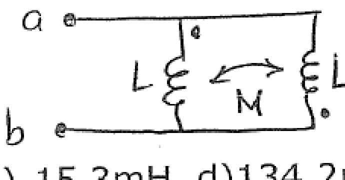
→a) V_2=100Cos(400t), ϕ_1=0.0005.Sin(400t)
b) V_2=50Cos(400t), ϕ_1=0.05.Sin(400t)
c) V_2=Cos(400t), ϕ_1=0.005.Sin(400t)
d) V_2=50Cos(400t), ϕ_1=0.5.Sin(400t)
e) None of the above

6.Find the equivalent inductance for the following connection:



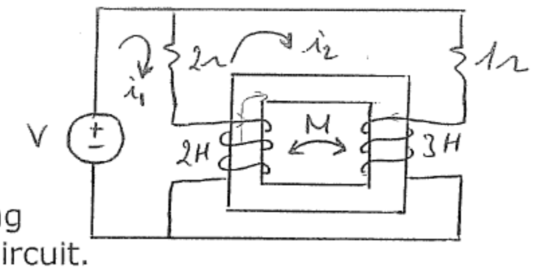
a)0mH b)40mH c)70mH d)120mH e)160mH

7.Find the equivalent inductance for the following connection , such that: L=60mH, L′=80mH and M=100mH.



a)34.2mH b)86.6mH c)-15.3mH d)134.2mH e)NOA

8. Given the circuit:
$i_1=4.Sin(t)$,
$i_2=3.Sin(t)$,
$k=2/\sqrt{6}$.
Find the governing equation of this circuit.



a) tan(t)=-3   b) tan(t)+3/5=0   c) tan(t)=2+Sin(t)
d) sin(t)+3cos(t)=1   e) None of the above

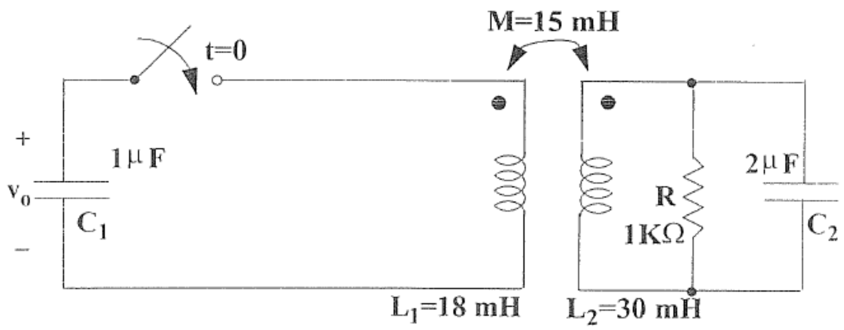


Figure 14

15. C_1 in figure 14 is initally charged to $V_0 = 6$ V and C_2 is uncharged. The switch is closed at t = 0. Calculate the energy dissipated in R.

a) 18μJ
b) 9μJ
c) 27μJ
d) 0
e) None of the above

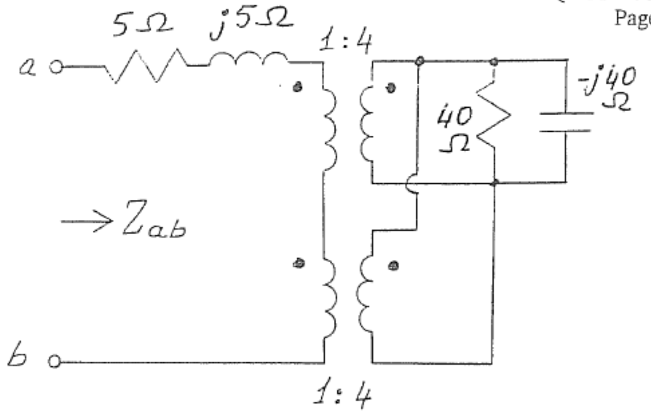


Figure 7.

7. Two identical transformers are connected as shown in figure 7. Determine the impedance Z_{ab}.

— A. 10 Ω
B. 15 Ω
C. 10 +j10 Ω
D. 10 – j10 Ω
E. None of the above

3. Calculate the voltages v_1 and v_2 in the circuit of Fig. 2.

A. v_1 = -10 cost V; v_2 = -9 cost V
B. v_1 = 10 cost V; v_2 = 9 cost V
— C. v_1 = 10 cost V; v_2 = -9 cost V
D. v_1 = 9 cost V; v_2 = -10 cost V
E. None of the above

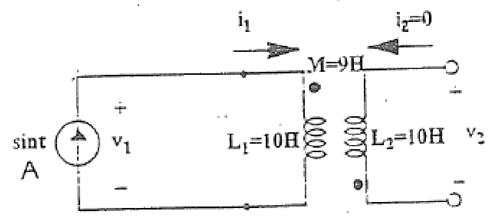


Figure 2.

8. Find the turns ratio for the ideal transformer shown in Fig. 7 required to match the 200 ohms source impedance to the 8 ohms load.

A. n = 3
B. n = 4
— C. n = 5
D. n = 6
E. None of the above

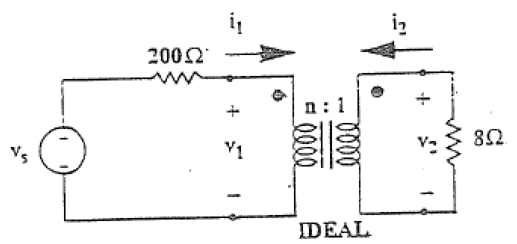


Figure 7.

15. Determine the Thevenin equivalent circuit between terminals *a* and *b* in Fig. 13 if $V_s = 10\angle 0°$ V.

A. $V_{Th} = 40$ V; $R_{Th} = 25\ \Omega$
B. $V_{Th} = 20$ V; $R_{Th} = 25\ \Omega$
C. $V_{Th} = 40$ V; $R_{Th} = 50\ \Omega$
D. $V_{Th} = 20$ V; $R_{Th} = 50\ \Omega$
E. None of the above

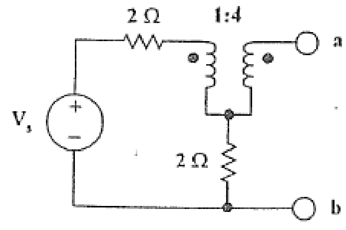


Figure 13

19. Determine L_{eq} in Fig. 16 if $L_3 = 1\ \mu$H.

A. 8 μH
B. 6 μH
C. 4 μH
D. 3 μH
E. None of the above

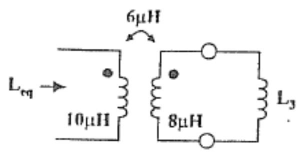


Figure 16

20. If $I_1 = 2$ A in Fig. 17, find the value of I_2 that will minimize the stored energy.

A. 1.33 A
B. 2 A
C. 0
D. 0.67 A
E. None of the above

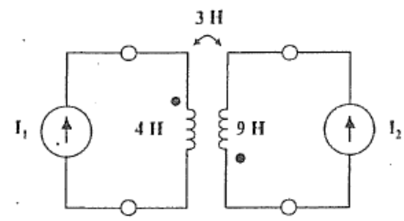
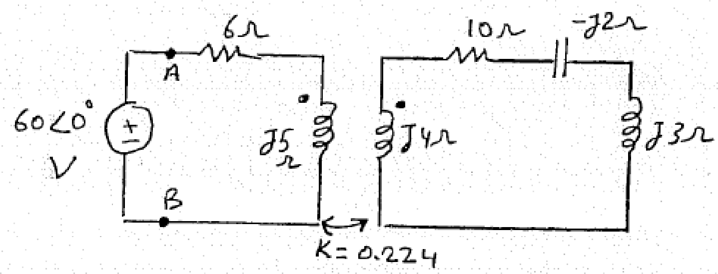


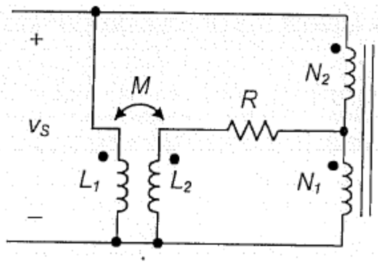
Figure 17

2. Find the input impedance Z_{AB} in the circuit shown below.

A. 6 + j 5. 896 Ω
B. 8.3 + j 4.7 Ω
C. 6.1 +J 5 Ω
D. 3.8 + j 9.2 Ω
E. None of the above

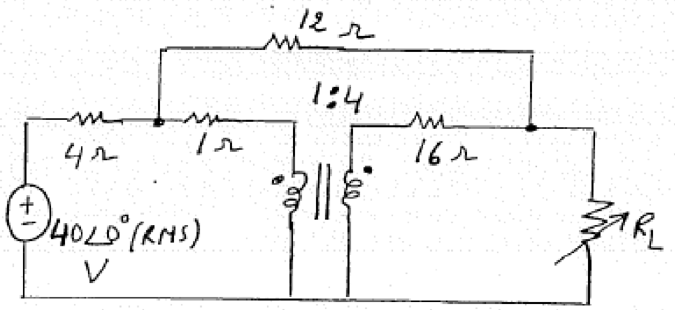


5. In the figure shown, v_S = 10cos100πt V, L_1 = 120 mH, L_2 = 30 mH, R = 100 ohms, N_1 = 400 turns, and N_2 = 1600 turns. Determine the coupling coefficient so that no current flows in the 100 ohm resistor.



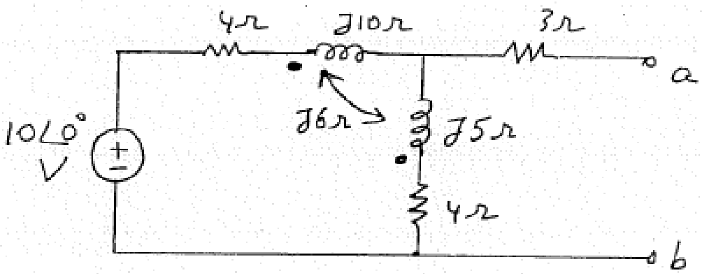
A. 0.4
B. 0.5
C. 0.6
D. 0.8
E. None of the above

8. Find the maximum average power given that R_L is adjusted for maximum power transfer.



A. 50 W
B. 10 W
C. 100 W
D. 25 W
E. None of the above

9. In the circuit shown below, find the Thevenin equivalent circuit as seen from terminals a-b.



A. V_{Thev}= 4.82<-34.60, V, Z_{Thev}= 8.62<48.79 Ω
B. V_{Thev}= 4.82< 34.60, V, Z_{Thev}= 8.62<40.38 Ω
C. V_{Thev}= 48.2<-34.60, V, Z_{Thev}= 86.2<48.79 Ω
D. V_{Thev}= 5<-34.60, V, Z_{Thev}= 8.1<48.79 Ω
E. None of the above

12. Consider a source Vs supplying the primary of a transformer. The secondary is connected to a purely capacitive load Zc. The primary impedance is Z1, the secondary impedance is Z2, and the mutual impedance between primary and secondary is Zm. Calculate the currents I1 at primary and I2 at secondary.

Given: Vs = 150 <0° V, Z1=j3600 Ω, Z2=j2500 Ω, Zm=j1200 Ω, Zc= -j2400

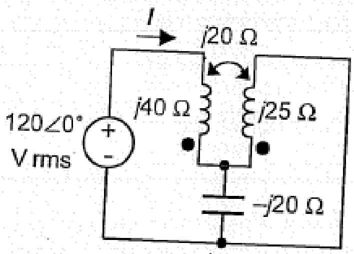
A. I1= 13.9 <-90° mA, I2=166.6<+90° mA
B. I1= 13.9 <0° mA, I2=166.6<+180° mA
C. I1= 33.5 <-90° mA, I2=356.5<+90° mA
D. I1= 33.5 <0° mA, I2=356.5<+180° mA
E. None of the above

1. Two magnetically coupled coils have a coefficient of coupling K=0.5. When they are connected in series, their total inductance is 80 mH. When connection of one of the coils is reversed, the total inductance becomes 40 mH. Specify which of the following represents the self-inductance of one of the coils L.

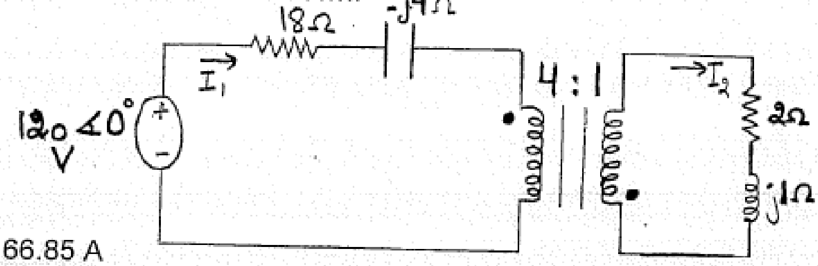
A. 60 mH
B. 52.36 mH
C. 40 mH
D. 5.64 mH
E. None of the above

8. Determine *I*.

A. +*j*4 A rms
B. −*j*6 A rms
C. −*j*4.8 A rms
D. −*j*8 A rms
E. None of the above

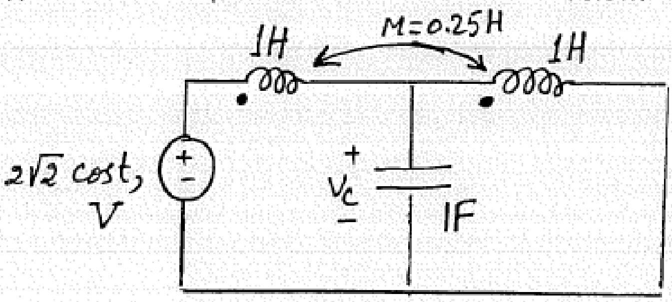


11. Determine I_2 in the circuit shown.



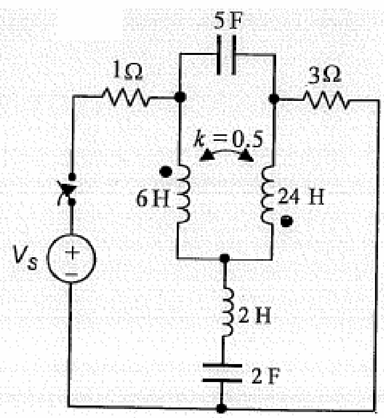
A. 25.61 <166.85 A
B. 3.56<-166.85 A
C. 16.42<-13.15 A
D. 9.33 <-193.15 A
E. None of the above

5. Find the voltage $V_c(t)$ across the capacitor of the circuit shown below.



a. 1.6 cost, V
b. 1.41 cost, V
c. 2.26 cos t, V
d. cost, V
e. None of the above

3. Determine the total energy stored in the capacitors and inductors after the switch has been closed for a long time, assuming $V_S = 8$ V.



A. 12 J
B. 30 J
C. 120 J
D. 148 J
E. None of the above

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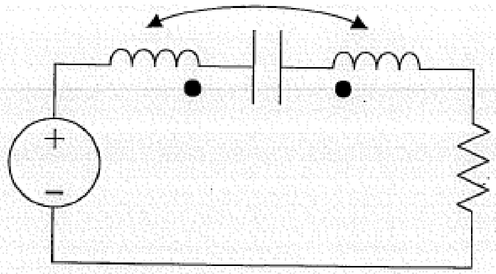
4. If the dot marking on one of the coils is reversed, the damping coefficient α:

A. increases
— B. decreases
C. remains the same



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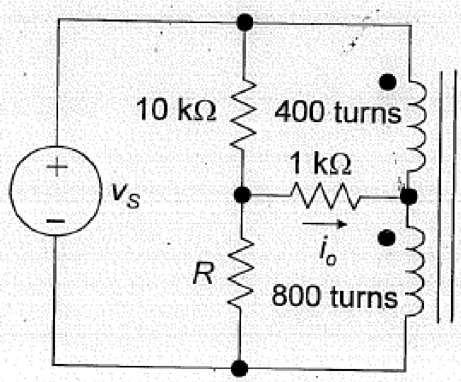
6. Determine R so that $i_o = 0$, assuming the autotransformer is ideal and $v_S = 10\cos 100\pi t$ V.

A. 5 kΩ
B. 10 kΩ
— C. 20 kΩ
D. 40 kΩ
E. None of the above



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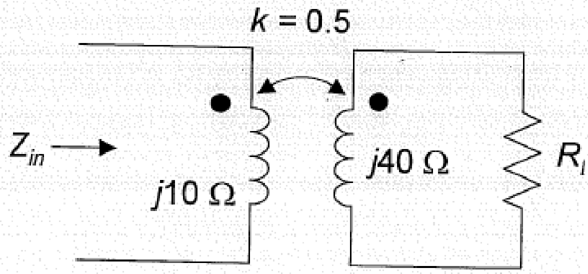
7. Determine the minimum value of Z_{in} as R_L is varied between zero and infinity.

A. $j5$ Ω
— B. $j7.5$ Ω
C. $j10$ Ω
D. 0
E. None of the above



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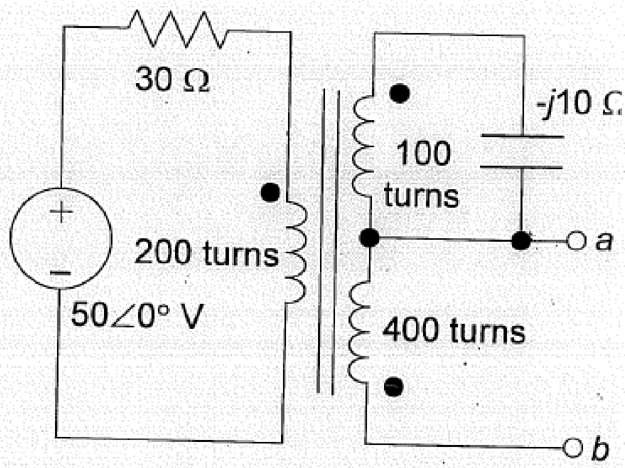
9. Determine Thevenin's equivalent circuit between terminals ab, assuming the transformer is ideal.

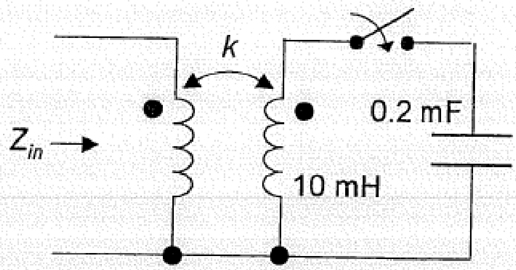
$V_{Th} = -64 + j48\ V$

$Z_{Th} = \frac{96}{5}(4 - j3)\ \Omega$



15. In the circuit shown, $Z_{in} = j20\ \Omega$ when the switch is open and $Z_{in} = j10\ \Omega$ when the switch is closed. Determine k, given that $\omega = 1$ krad/s.

a. 0
b. 0.5
c. 0.25
d. 0.75
e. None of the above



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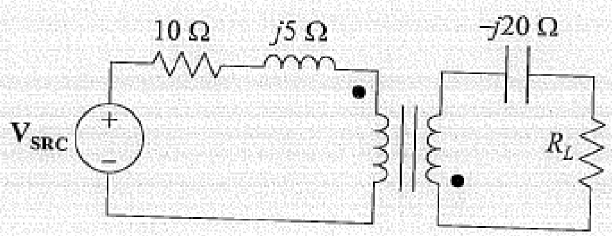
4. R_L and the turns ratio of the ideal transformer can be varied over an arbitrary range. Determine R_L for maximum power transfer to it.



A. 10 Ω B. 20 Ω C. 30 Ω D. 40 Ω E. None of the above

Solution: To have the reactances add to zero, the transformer turns ratio must be 2, primary-to-secondary. Hence $R_L = 4 \times 10 = 40\ \Omega$.

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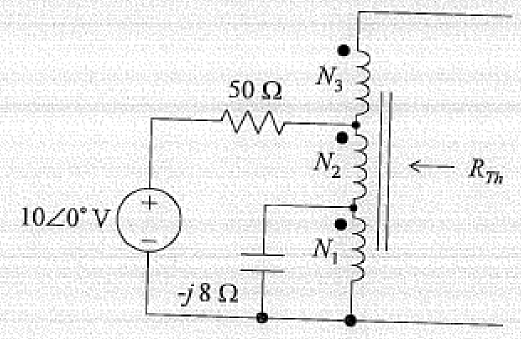
9. Given an ideal autotransformer having three windings of $N_1 = 200$ turns, $N_2 = 300$ turns, and $N_3 = 500$ turns. Determine R_{Th}.

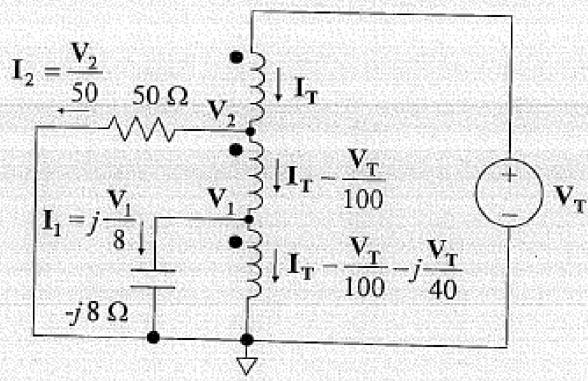


Solution: $\mathbf{V}_2 = \mathbf{V_T}\dfrac{500}{1000} = \dfrac{\mathbf{V_T}}{2}$,

$\mathbf{I}_2 = \dfrac{\mathbf{V}_2}{50} = \dfrac{\mathbf{V_T}}{100}$.

$\mathbf{V}_1 = \mathbf{V_T}\dfrac{200}{1000} = \dfrac{\mathbf{V_T}}{5}$, $I_1 = \dfrac{1}{-j8}\mathbf{V}_1$

$= \dfrac{j}{40}\mathbf{V_T}$. The currents in the various windings are as shown. The total mmf must be zero. Thus:



$$500\mathbf{I_T} + 300\left(\mathbf{I_T} - \frac{\mathbf{V_T}}{100}\right) + 200\left(\mathbf{I_T} - \frac{\mathbf{V_T}}{100} - j\frac{\mathbf{V_T}}{40}\right) = 0;\ 1000\mathbf{I_T} = ((3 + 2 + j5)\mathbf{V_T};\ \frac{\mathbf{V_T}}{\mathbf{I_T}} =$$

$$\frac{200}{1+j} = 100(1-j)\Omega.,\ R_{Th} = 100\ \Omega.$$

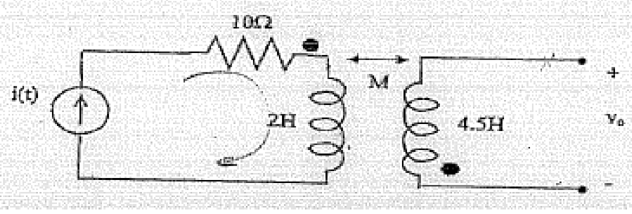
The sinusoidal current source i(t) is given by:

$$i(t) = 10\sin(120\pi t)(\text{Amps})$$
$$t \geq 0$$

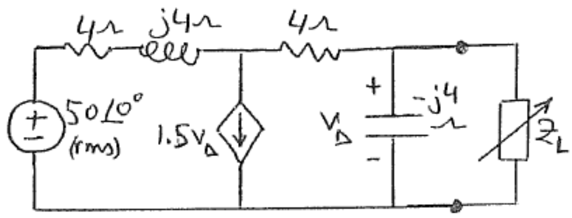
This current is applied to the primary coil of a transformer, as shown below. The primary coil (self-inductan 2H) is 100%-coupled to the secondary coil (self-inductance 4.5H).

Find the value of the voltage v_o at t = 0.

(a) 15.75 kV
(b) -11.31 kV
(c) -15.75 kV
(d) 11.31kV
(e) None of these



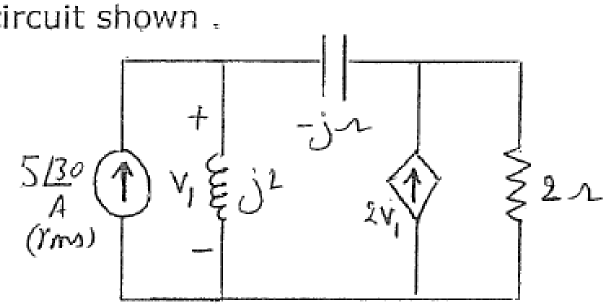
-3- The load impedance Z_L for the circuit shown is adjusted until maximum average power is delivered to the load. Find this maximum power.



a. 5W b. 25.34W c. 296.8W d. 7.81W e. None of the above

-5- How much complex power is delivered by the 5∠30 (rms) current source to the circuit shown .

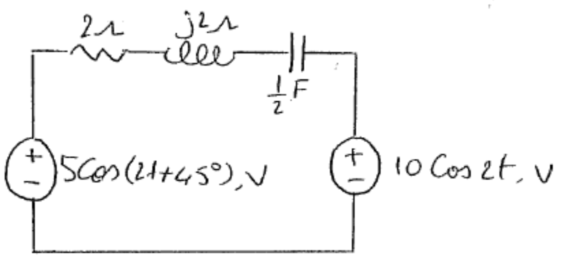
a. 7.5∠137.48 VA
b. 0 VA
c. 100 VA
d. 15.35 ∠137.48 VA
e. None of the above



-7- An impedance Z=(4+j4)Ω is connected in parallel with an impedance Z'=(12+j6)Ω. If the input reactive power is 2500 var lagging, what is the total average power?

a. 3025 b. 2500 c. 5000 d. 21250 e. None of the above

-8- In the circuit shown, find the average power delivered by the sources.



a. 1.47W b. 19.4W
c. 9.41W d.10.88W
f. None of the above

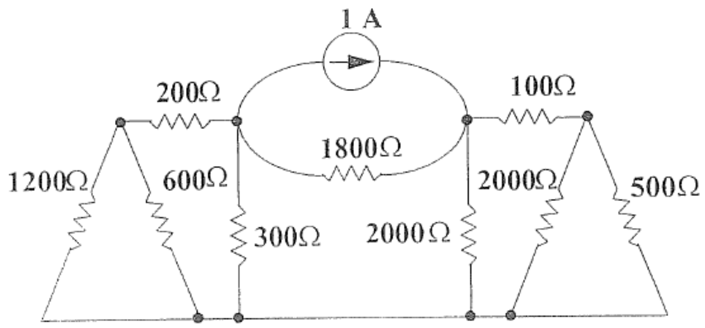


Figure 3

4. Given the circuit of figure 3. Find the power (p_{source}) supplied by the source and also the power (p_{1800}) absorbed by the 1800Ω resistor.

a) p_{source} = 450 W ; p_{1800} = 112.5 W
b) p_{source} = 4.5 W ; p_{1800} = 1.125 W
c) p_{source} = 112.5 W ; p_{1800} = 28.125 W
d) p_{source} = 18 W ; p_{1800} = 4.5 W
e) None of the above

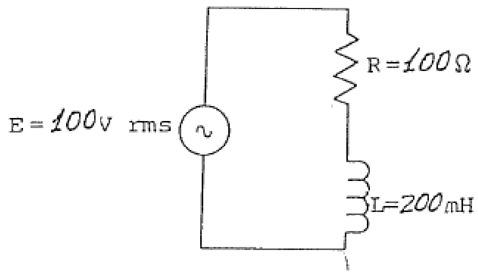


Figure 3.

3. Determine the power dissipated in the load in the circuit shown in figure 3. f = 60 Hz.

A. 38.8 W
— B. 63.8 W
C. 52.5 W
D. 45.3 W
E. None of the above

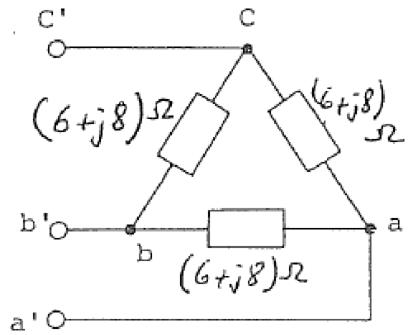


Figure 6.

6. Find the total real power in the delta-connected load shown in figure 6. $V_{ba} = 220\angle 0°$ V, $V_{cb} = 220\angle -120°$ V, $V_{ac} = 220\angle +120°$ V, all rms.

A. 7.8 kW
B. 8.7 kW
C. 6.8 kW
D. 5.9 kW
E. None of the above

14. Calculate the power dissipated in the resistor in Fig. 12 if $v_1(t) = 10\cos t$ and $v_2(t) = 10\cos 3t$.

A. 12.7 W
— B. 50.7 W
C. 60.8 W
D. 70.5 W
E. None of the above

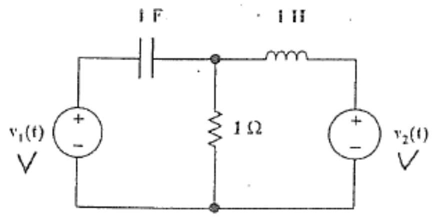


Figure 12

3. An impedance Z1= (4+j4) Ω is connected in parallel with an impedance Z2= (12+j6) Ω. If the input reactive power is 2500 VAR (lagging), what is the total active (average) power ?

A. 1210 W
B. 3025 W
C. 2066 W
D. 1350 W
E. None of the above

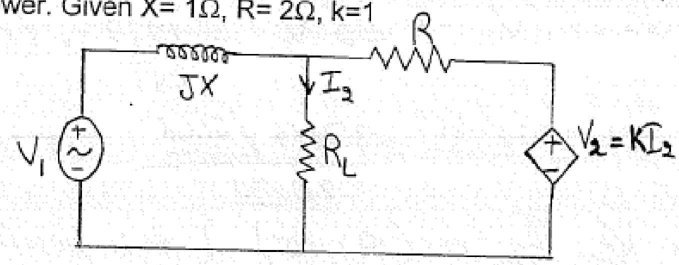
4. The conjugate of the complex power delivered by a current source is $400 - j400$ VA. If the source current is $\frac{10}{\sqrt{2}}\angle 45^\circ$ A peak, determine the rms voltage across the source.

A. 40 V rms
B. $j40$ V rms
C. $j80$ V rms
D. $-j40$ V rms
E. None of the above

2. Two impedances Z1 and Z2 when connected separately across a 230-V (RMS), 50-Hz supply consumed 100 W and 60 W at power factors of 0.5 lagging and 0.6 leading respectively. If Z1 and Z2 are now connected in series across the same supply, find the total average (active) power absorbed by the two impedances.

A. ~147.78 W
B. ~103.67 W
C. ~87.52 W
D. ~99.2 W
E. None of the above

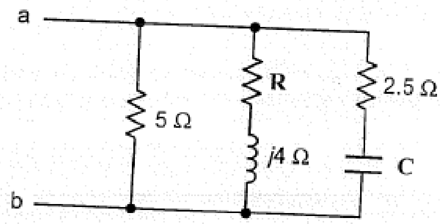
4. Consider the following circuit where V2 is a current dependent source of voltage. R_L is a variable pure resistive load. Calculate the value of R_L that dissipates the maximum average power. Given X= 1Ω, R= 2Ω, k=1



A. √5 Ω
B. 1/√5 Ω
C. 2/√5 Ω
D. 2 Ω
E. None of the above

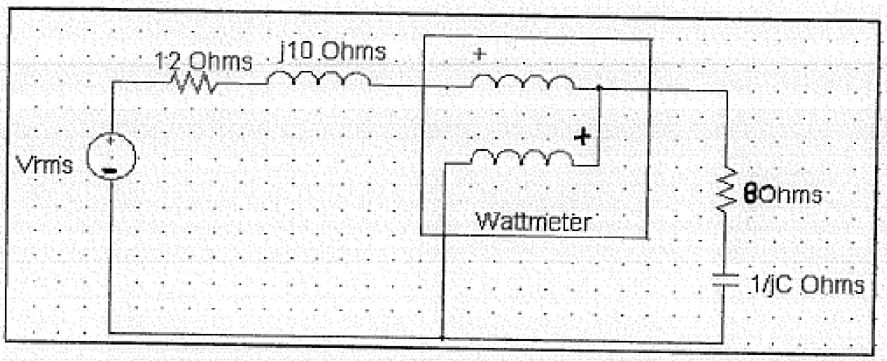
(70)

7. Given that the complex power absorbed by the inductive branch is 12 + *j*16 VA, find the smallest *C* that gives unity power factor at terminals ab, assuming ω = 1 rad/s.



A. 0.2 F
B. 0.1 F
C. 0.05 F
D. 0.15 F
E. None of the above

18. Find the wattmeter reading of the circuit below. Where C = 1/2 F
$V_{rms} = 150 < 0^\circ V$



(a) P = 387.93 W
(b) P = 412.84 W
(c) P = 445.54 W
(d) P=279.4 W
(e) None of the above

21. The values of R_1, R_2, C and L are unknown. Load 1 absorbs a complex power of $50\angle-45°$ VA and Load 2 absorbs a complex power of $100\angle+45°$ VA. Determine R_2 if $\mathbf{V_s} = 125\angle0°$ V.

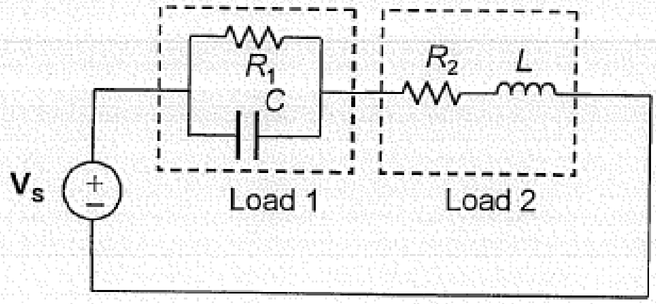
A. $250\sqrt{2}\ \Omega$

B. $125\sqrt{2}\ \Omega$

C. $125\ \Omega$

— D. $125/\sqrt{2}\ \Omega$

E. None of the above



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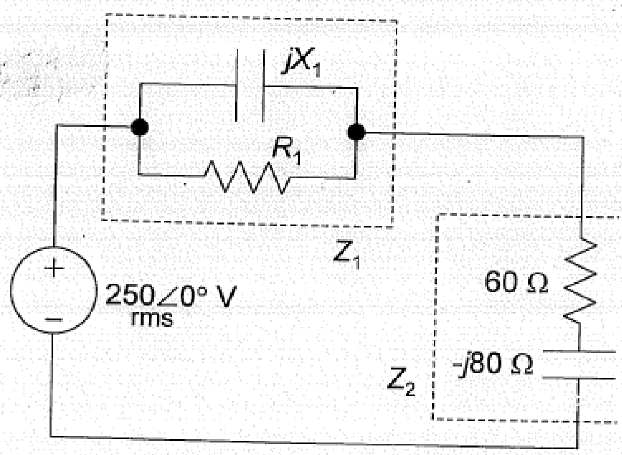
10. The impedance Z_2 consumes 4 times the complex power of Z_1

Determine R_1 and X_1.

✓ $R_1 = 125\ \Omega$ 3

✓ $X_1 = -125\ \Omega$ 4



5. A voltage is given by v=60 sin (ωt) + 24 sin (3ωt+ π/6) + 12 sin (5ωt+π/3) is applied across a certain circuit. The resulting current is given by:
I=0.6 sin (ωt- 2π/10) + 0.12 sin (3ωt- 2π/24) + 0.1 sin (5ωt-3π/4)

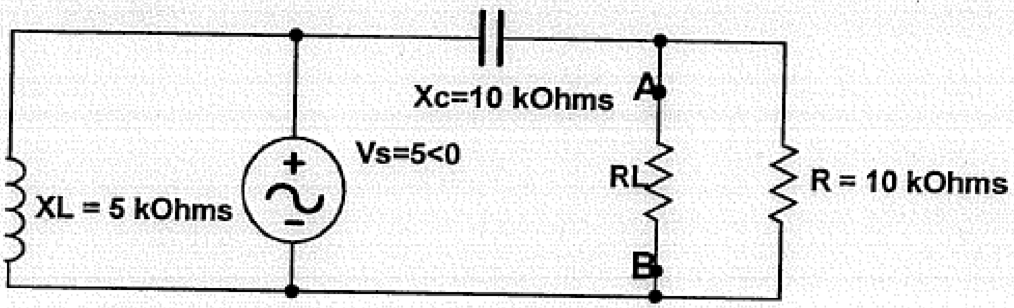
Find the absolute value of the total average power supplied by the source

A. 14.56 W
B. 21.35 W
C. 9.77 W
D. 15.74 W
E. None of the above

6. In problem 5, find the overall power factor of the circuit.

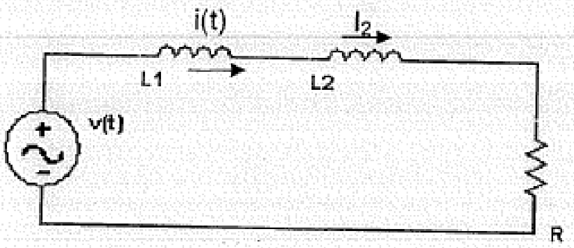
A. 0.77
B. 0.59
C. 0.24
D. 0.62
E. None of the above

9. What should be the value of resistance R_L for maximum power to be transferred to it?



a. $R_L = 5K\Omega$
b. $R_L = 10K\Omega$
c. $R_L = 7.62K\Omega$
d. $R_L = 7.07K\Omega$
e. None of the above

13. An inductor L2 = 2H, an inductor L1 = 1H and a resistor R = 6Ω are connected in series to a voltage source $v(t) = 2\,t\,e^{-3t}u(t)$. The initial energy stored in L2 was 25J. No initial energy was stored in L1. Find the current i(t) in this circuit at $t \geq 0$.



a. $i(t) = [4\,\delta(t) + 4\,e^{-2t} + 2/3\ t\,e^{-3t}]\,u(t)$
b. $i(t) = [4\,e^{-2t} - 2/3\ e^{-3t} - 2/3\ t\,e^{-3t}]\,u(t)$
c. $i(t) = [4\,e^{-2t} + 2/3\ e^{-3t} + 2/3\ t\,e^{-3t}]\,u(t)$
d. $i(t) = [4\,e^{-2t} - 2/3\ e^{-3t}]\,u(t)$
e. None of the above

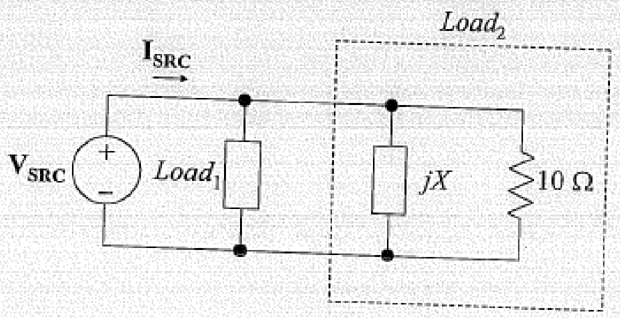
14. Three loads are connected in parallel across a 2400V (rms) source. Load 1 absorbs 24KW and 60KVAR, load 2 absorbs 18kVA at 0.6 pf lead and load 3 absorbs -12kVAR at zero power factor.

Find the impedance that is equivalent to the three parallel loads.

a. Z = 44.26 + j 73.26 Ω
b. Z = 24.75 + j 52.26 Ω
c. Z = 13.54 + j 35.62 Ω
d. Z = 85.6 + j 58.86 Ω
e. None of the above

8%

5. The complex powers absorbed by L_1 and L_2 are $1 + j0.2$ kVA and $1 - j0.2$ kVA. Determine $\mathbf{I}_{\mathbf{SRC}}$, assuming that the phase angle of $\mathbf{V}_{\mathbf{SRC}}$ is zero. Note that X need not be given.



A. $20\angle 90^\circ$ A

B. $10\angle 90^\circ$ A

C. $10\angle 0^\circ$ A

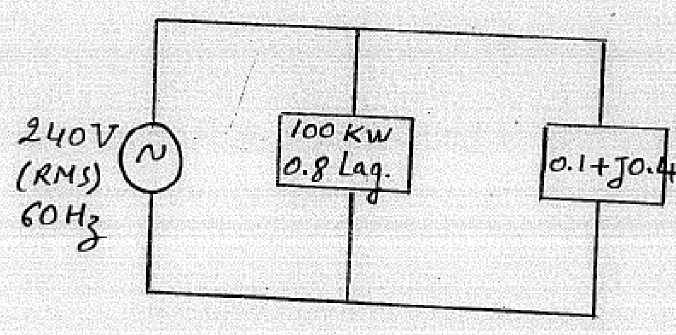
D. $20\angle 0^\circ$ A

E. None of the above

***Solution*:** The complex power delivered by the source is 2 kVA. The real power absorbed by L_2 is in the 10 Ω resistor. If $\mathbf{V}_{\mathbf{SRC}} = V_m\angle 0$ V, then $\frac{|V_m|^2}{10} = 1000$, or $V_m = 100$ V. It follows that $I_m = \frac{2000}{100} = 20$ A, and $\mathbf{I}_{\mathbf{SCR}} = 20\angle 0$ A.

5. An electric motor draws an active power of 100 kW at 0.8 p.f lagging from a 240 V, 60 Hz source. This motor is connected in parallel to another load of $0.1 + j0.4\ \Omega$. What is the size of the parallel connected capacitor needed to raise the total power factor to 0.95 lagging.

a. 6.27 mF
b. 4.25 mF
– c. 7.68 mF
d. 2.88 mF
e. None of the above



8. A 300-V voltmeter that draws 2mA current for full-scale reading is used to measure the voltage across the 50-KΩ resistor of Figure 6. The voltmeter reading is:

a. 60V
b. 120V
c. 40V
d. 90V
e. None of the above

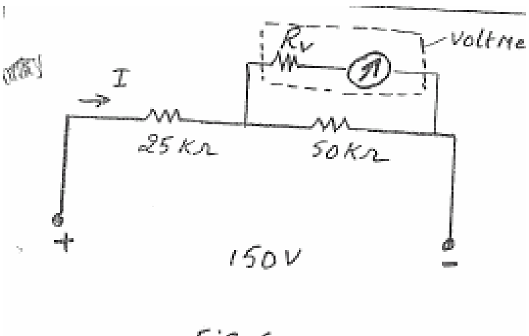


Fig.6

15. A 50Ω, 0.1A d'Arsonval meter movement is used in a voltmeter circuit (Figure 13). Determine the voltmeter reading across the terminals x-y on a full-scale of 30V.

a. 26.49V
b. 32V
c. 31.79V
d. 36V
e. None of the above

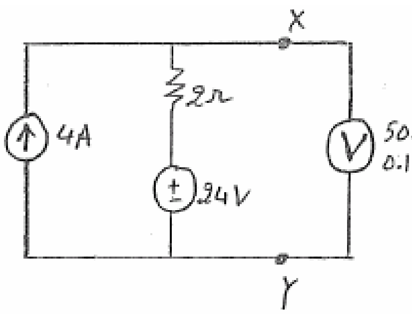
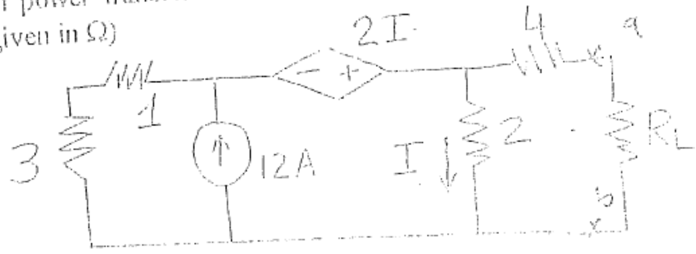


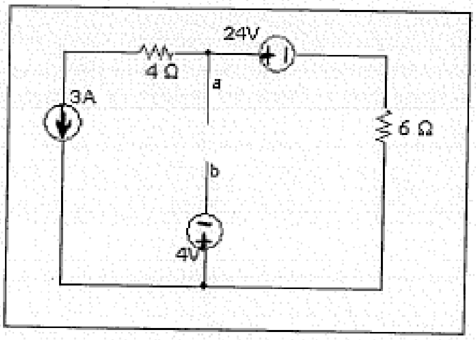
Fig. 13

12 - Determine the maximum power transfer to the load RL in the following network. (The resistance are given in Ω)



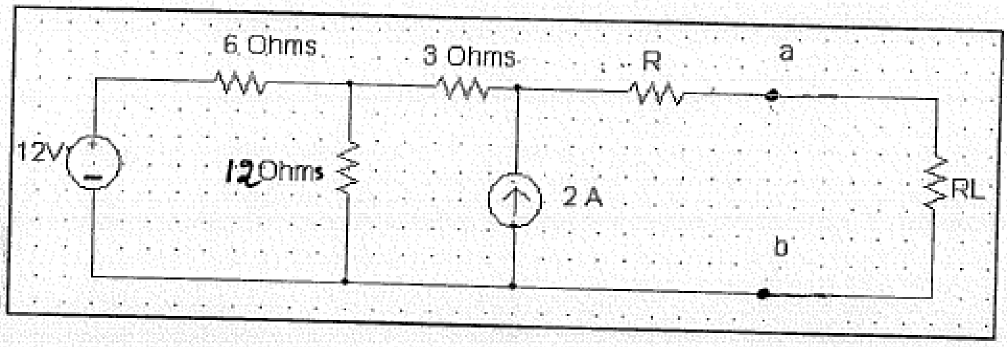
→ a) 24 W
b) 36 W
c) 6 RL
d) 36 RL
e) none of the above

10. A load resistance in the range of [1,5] Ω is to be connected across the terminals a,b in such a way that maximum power is delivered to it. Determine the power dissipated by R.



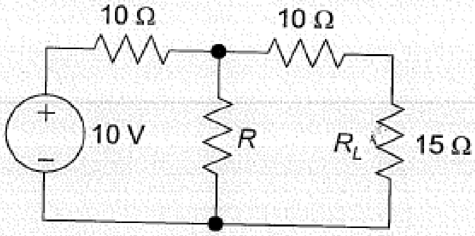
a) 10.58 W
b) 4.13 W
c) 5.95 W
d) 8.26 W
e) none of the above

13. Find the maximum power transfer in the circuit below, where R = 2Ω



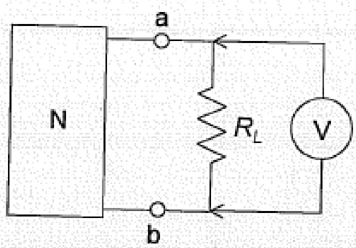
(a) 13.44 W
(b) 10.08 W
(c) 12.1 W
(d) 8.34 W
(e) None of the above

7%
4. For what value of R is maximum power transferred to R_L?



A. 10 Ω
B. 15 Ω
C. 20 Ω
→ D. Infinite resistance
E. None of the above

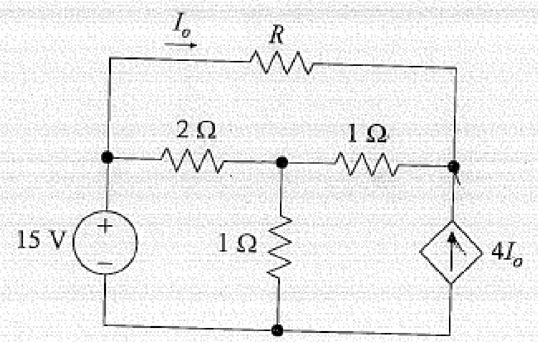
7%
5. A circuit N has an open-circuit voltage of 15 V between terminals ab, and an unknown source resistance R_S. A voltmeter across ab reads 12 V when R_L = 10 kΩ and 10 V when R_L = 40/9 kΩ. Determine R_S and R_V, the resistance of the voltmeter.



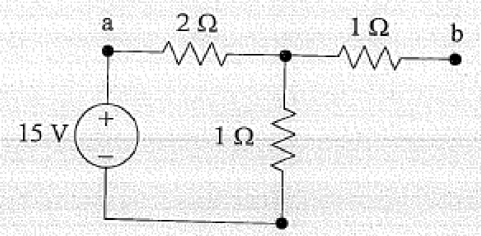
→ A. R_S = 2 kΩ, R_V = 40 kΩ
B. R_S = 2 kΩ, R_V = 80 kΩ
C. R_S = 4 kΩ, R_V = 40 kΩ
D. R_S = 4 kΩ, R_V = 80 kΩ
E. None of the above

17%

7. Determine R for maximum power transfer to it and the value of this power.



Solution: When R is replaced by an open circuit, the current source is set to zero. The circuit becomes as shown. $V_{Th} = V_{ab} = 15\times\frac{20}{30} = 10\text{ V}$.



When a source V_T is applied, with the 15 V short circuited, and I_T as shown, the polarity of the current source is reversed. From KVL: $V_T = 5I_T(1+2\|1)$. This gives $\frac{V_T}{I_T} = R = R_{Th} = \frac{25}{3}$ Ω. Max power transferred is $\frac{100}{4\times 25/3} = 3\text{ W}$.