Practice Problems

(If you attempt only a few, select those with a star.)

DC Circuits

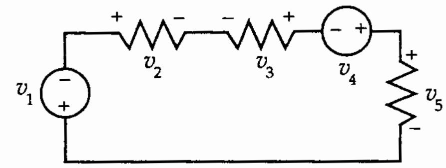
*6.1 For the circuit below, with voltages' polarities as shown, KVL in equation form is

a) $v_1 + v_2 + v_3 - v_4 + v_5 = 0$

b) $-v_1 + v_2 + v_3 - v_4 + v_5 = 0$

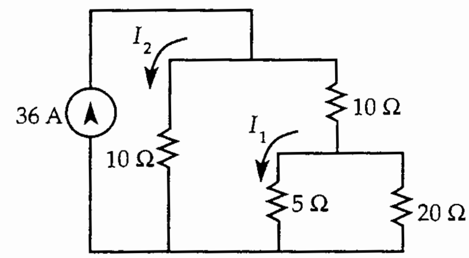
c) $v_1 + v_2 - v_3 - v_4 + v_5 = 0$

d) $-v_1 - v_2 - v_3 + v_4 + v_5 = 0$



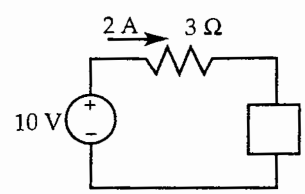
6.2 Find I_1 in amps.

a) 12
b) 15
c) 18
d) 21



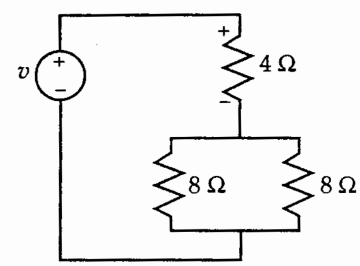
*6.3 Find the magnitude and sign of the power, in watts, absorbed by the circuit element in the box.

a) –20
b) –8
c) 8
d) 12



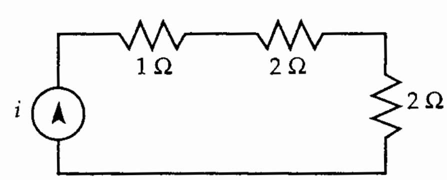
*6.4 For the circuit shown, the voltage across the 4 ohm resistor is, with $v = 1$ V

a) 1/4
b) 1/2
c) 2/3
d) 2

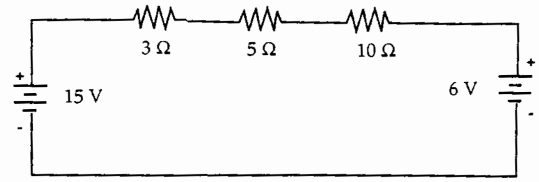


6.5 The total conductance, in mhos, in the circuit shown below is

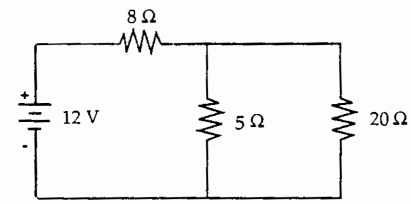
a) 1/5
b) 1/2
c) 2
d) 5



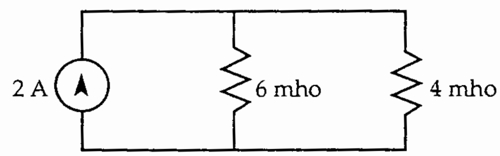
6.6 The voltage across the 5 ohm resistor in the circuit shown is
a) 1.0
b) 2.5
c) 3.0
d) 5.83



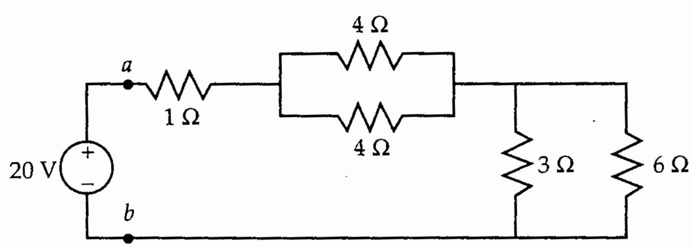
6.7 The power delivered to the 5 ohm resistor is
a) 1.5
b) 2.15
c) 2.85
d) 3.2



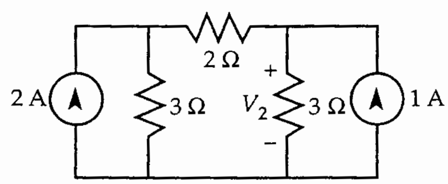
6.8 The power, in watts, absorbed by the 6 mho conductance in the circuit below is
a) –0.24
b) 0.2
c) 0.24
d) 0.48



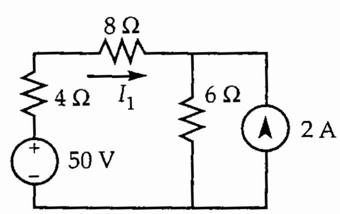
*6.9 The equivalent resistance, in ohms, between points *a* and *b* in the circuit below is
a) 3
b) 5
c) 7
d) 8



6.10 The voltage V_2 is
a) 6.4
b) 4.0
c) 2.0
d) 5.6



6.11 Find I_1 in amperes.
a) 4.0
b) 2.0
c) 4.11
d) 2.11

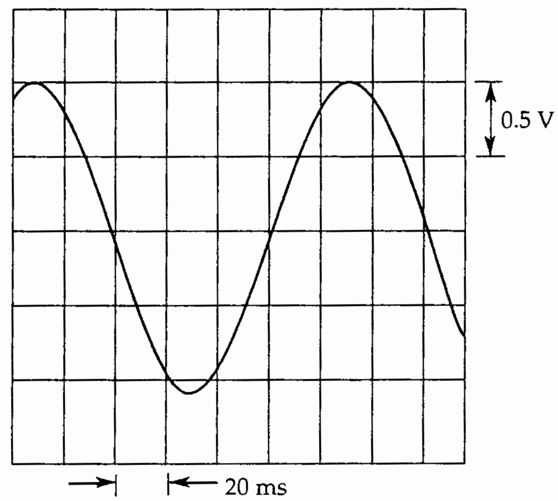


AC Circuits —Single Phase

*6.12 $(2+j2)(3-j4)$ is most nearly

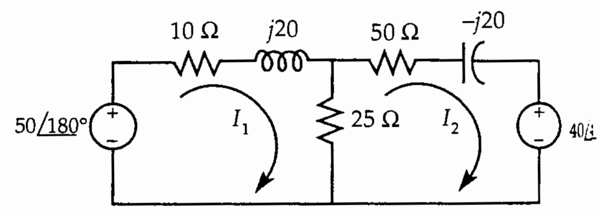
a) $6.0\angle -21.8°$ b) $14.1\angle -21.8°$ c) $14.1\angle -8.1°$ d) $28.0\angle -8.1°$

*6.13 The following sinusoid is displayed on an oscilloscope. The RMS voltage and the radian frequency are most nearly



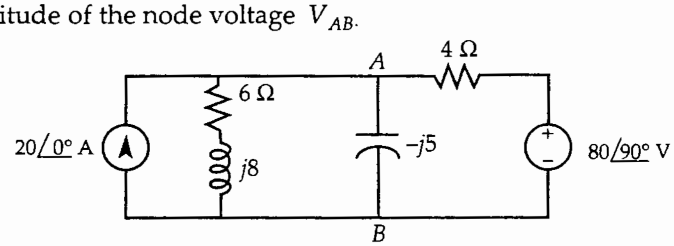
a) 1, 8.33
b) 0.7071, 52.36
c) 1.4142, 52.36
d) 2, 8.33

6.14 Find I_2 in amperes.



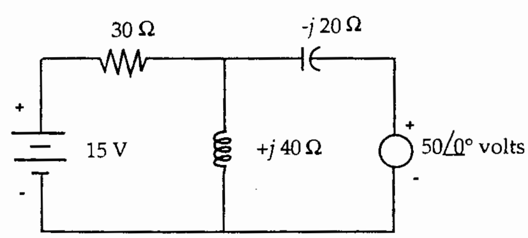
a) 0.29+j0.68
b) −0.12+j0.69
c) −0.82−j0.37
d) 1−j2

*6.15 Calculate the magnitude of the node voltage V_{AB}.



a) 85.1
b) 77.2
c) 68.8
d) 92.2

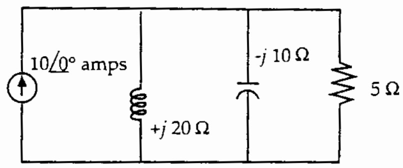
6.16 The DC (average) current through the $+j$ 40 ohm inductor is



a) 0.3 A b) 0.5 A c) 0.8 A d) 1.2 A

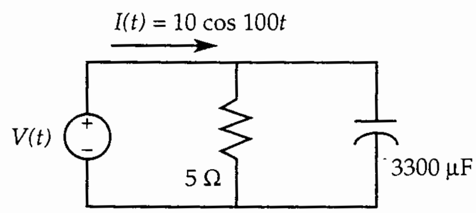
6.17 The rms current through the $+j$ 40 ohm inductor of Problem 6.16 is
a) 0.5 A b) 0.93 A c) 1.58 A d) 2.11 A

6.18 The current through the capacitor is
a) 0.21 A
b) 0.57 A
c) 1.0 A
d) 4.85 A

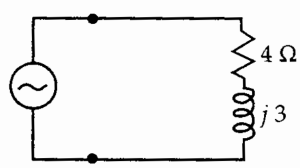


6.19 The voltage across the 5-ohm resistor of Problem 6.18 is
a) 0.50 V
b) 1.61 V
c) 2.06 V
d) 48.5 V

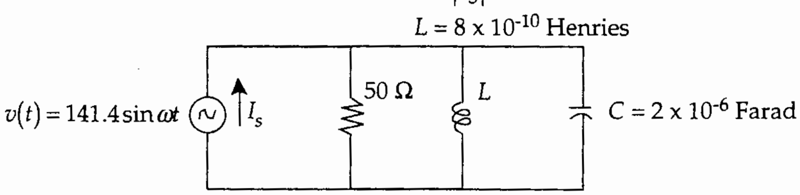
6.20 The peak value of $V(t)$ in the circuit shown is approximately
a) 2.0
b) 3.68
c) 25.9
d) 50.0



*6.21 The power factor of the circuit shown is most nearly
a) 0.5
b) 0.6
c) 0.7
d) 0.8



6.22 What value of ω will make the *rms* of $|I_S|$ a minimum in the circuit shown?

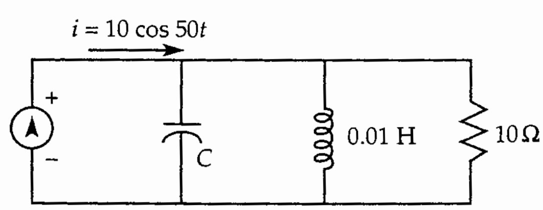


a) 2×10^6 b) 8×10^6 c) 25×10^6 d) 50×10^6

6.23 What is the *rms* magnitude of the minimum source current in the circuit of Problem 6.22?
a) 1.0 b) 1.5 c) 2.0 d) 2.5

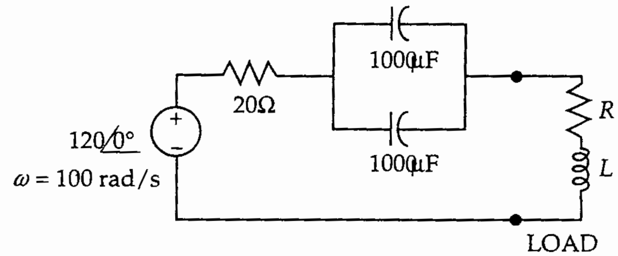
6.24 For the circuit shown, the value of capacitance C that will give a power factor of 1.0 is most nearly

a) 0.0173
b) 0.0519
c) 0.0938
d) 0.0393



6.25 For maximum power dissipation in the load of the circuit shown, R (in ohms) and L (in milli-henries) should be chosen as

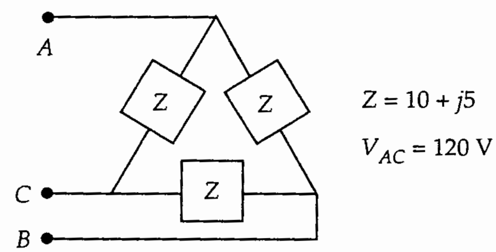
a) 26, 50
b) 20, 100
c) 20, 50
d) 25, 100



AC Circuits —Three Phase

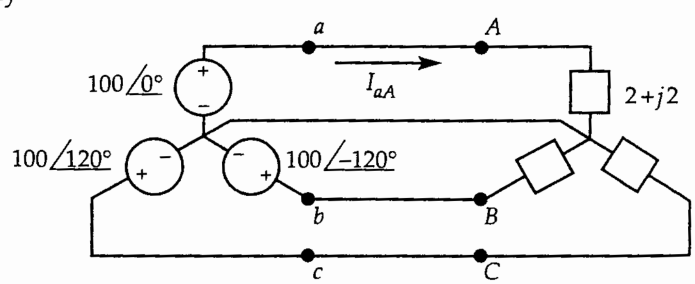
*6.26 Calculate the total average power, in watts, dissipated in the balanced three phase load.

a) 2507
b) 5276
c) 3456
d) 978



6.27 The value of the line current I_{aA} in the balanced Y-connected system shown is most nearly

a) $20.6\angle 30°$
b) $35.3\angle -45°$
c) $35.3\angle 45°$
d) $15.1\angle -30°$

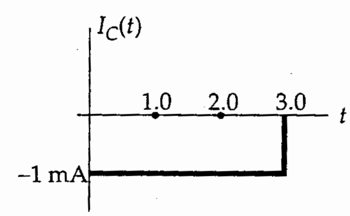


*6.28 For a balanced Y-connected system identify the incorrect statement.

a) $V_{PH} = \sqrt{3}\, V_L$
b) $I_L = I_{PH}$
c) $P_{total} = 3P_{PH}$
d) All phase impedances are equal.

6.29 A 100 µF capacitor has $I_C(t)$. The capacitor voltage $V_c(t)$ at $t = 2.5$ seconds $(V(0) = 1.0\text{ V})$ is most nearly

a) −24
b) −25
c) 25
d) 26

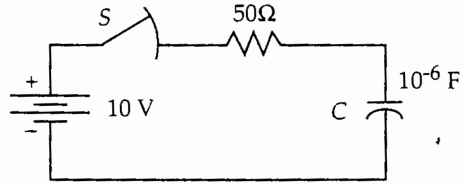


6.30 The voltage across a 10 μF capacitor is $50t^2$ V. The time, in seconds, it will take to store 200 J of energy is most nearly

a) 0.15 b) 0.21 c) 1.38 d) 11.25

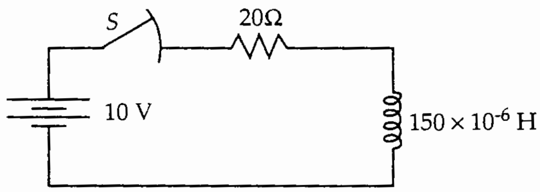
*6.31 The value of the voltage across C at $t = 30 \times 10^{-6}$ s, if the switch is closed at t = 0, is

a) 3.51
b) 4.51
c) 5.46
d) 6.32



6.32 How long, in microseconds, does it take for the current to reach half its final value, if the switch is closed at t = 0?

a) 3.1
b) 4.7
c) 5.2
d) 7.3



Electric Fields

*6.33 The electric flux passing out through a closed surface is equal to

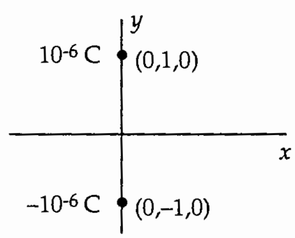
a) the line integral of the current around the surface.
b) zero.
c) the flux density at the surface.
d) the total charge enclosed by the surface.

*6.34 The direction of the force acting on a moving charge placed in a magnetic field is

a) perpendicular to the magnetic field.
b) opposite to the direction of motion of the charge.
c) along the direction of the magnetic field.
d) along the direction of motion of the charge.

6.35 Two infinitely long lines of charge are parallel to the z-axis and located as shown. The force on an electron at (1,0,0) will be in the direction

a) $+x$
b) $-x$
c) $+y$
d) $-y$



6.36 A point charge of 2×10^{-7} C is located at the origin of coordinates. A spherical shell with center at the origin and radius of 20 cm has a surface charge density 1×10^{-7} C/m^2. The electric flux density at r = 50 cm, in C/m^2, is

a) 3.18×10^{-8} c) 9.55×10^{-8}

b) 7.96×10^{-8} d) 11.14×10^{-8}

*6.37 A uniform line charge of $\rho_L = 30$ nC/m lies along the z-axis. The flux density D at (3,–4,5) is:

a) 1.91×10^{-10} c) 11.94×10^{-10}
b) 9.55×10^{-10} d) 15.92×10^{-10}

6.38 An electric field in rectangular coordinates is given by $\mathbf{E} = 4y\mathbf{x} + 4xy$ V/m. The voltage drop from (1,1,1) to (5,1,1) is
a) +12 b) –12 c) +16 d) –16

6.39 Static electric field distributions refer to cases where

a) all time derivatives of field quantities are zero.
b) the time derivatives of the displacement current are not zero.
c) the electric fields vary with time.
d) the electric scalar potential is two-dimensional.

*6.40 A point charge of 50×10^{-9} C is placed 10 cm above a perfectly conducting infinitely large flat ground plane. What is the voltage 5 cm above the ground with respect to zero volts on the ground?
a) 3000 b) 4000 c) 5000 d) 6000

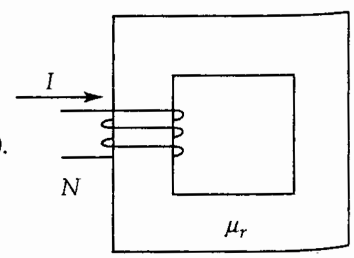
Magnetic Fields

*6.41 Two long, straight conductors located at (0,3,z) and (0,–3,z) each carry 5 amperes in the same direction (distances are in meters). The magnitude of magnetic field intensity at (4,0,0) is
a) $1/\pi$ b) $2/5\pi$ c) $3/5\pi$ d) $4/5\pi$

6.42 A solenoid has 1000 turns and carries a current of 5 amperes. If L = 50 cm and $r_c = 2.5$ cm, what is the magnetic field intensity on the solenoid axis at the center of the solenoid?

a) 10^4 b) 2×10^5 c) 5×10^4 d) 10^5

*6.43 The inductor shown has an inductance of 4 mH. In order to increase the inductance to 40 mH,
a) increase the current by 10.
b) increase the mean flux path length by 10.
c) increase the number of turns to 10 N.
d) increase the cross sectional area of the iron by 10.



6.44 An iron ring with a mean diameter of 20 cm is wound with a coil of 200 turns. The permeability of the iron is $4\pi \times 10^{-4}$ H/m. A current of 0.05 A is passed through the coil. The magnetic flux density in the iron, in W/m^2, is

a) 0.02 b) $0.01\pi^2$ c) $100/\pi$ d) π

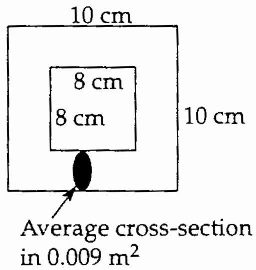
*6.45 An iron core is shown. The relative permeability of the iron is 4000. The reluctance, in H^{-1}, of the magnetic circuit shown is

a) $1/(\pi \times 10^{-8})$

b) $1/(4\pi \times 10^{-5})$

c) $1/(4\pi \times 10^{-8})$

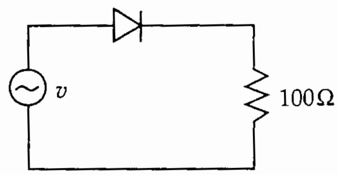
d) $1/(16\pi \times 10^{-8})$



Diodes

*6.46 If the desired DC load voltage is 9 volts, what is the rms value of the source?

a) 4.1
b) 12.7
c) 20.0
d) 28.3

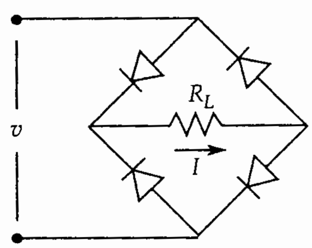


6.47 If the source voltage in the circuit of Prob. 6.46 is $v = 100 \sin 377t$, the peak reverse voltage applied to the diode would be

a) 2.5 b) 100 c) 141.4 d) 31.8

6.48 If $R_L = 600\ \Omega$, what must be the rms value of the sinusoidal voltage v if $I = 150$ mA?

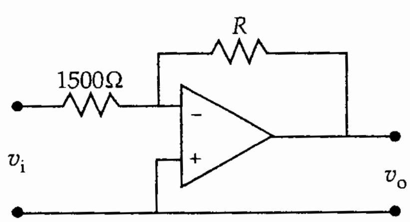
a) 60
b) 80
c) 100
d) 120



Operational Amplifiers

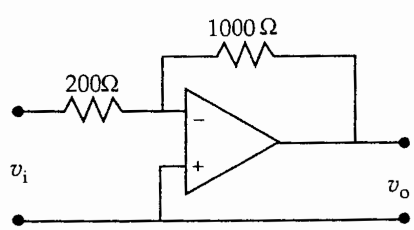
*6.49 Calculate R, in kΩ, so that $v_o/v_{in} = -200$.

a) 50 kΩ
b) 100
c) 200
d) 300



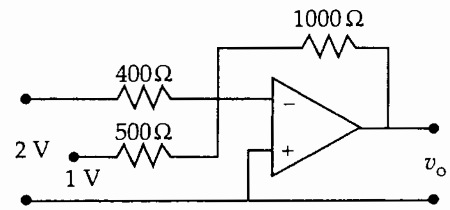
6.50 The gain of the following OP-AMP circuit is

a) –0.2
b) –1.2
c) –4
d) –5



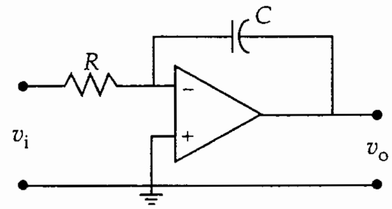
6.51 Given the voltages into the following OP-AMP network, the output voltage is

a) –2
b) –4
c) –7
d) –10



*6.52 The OP-AMP circuit below performs the function of

a) amplification
b) integration
c) differentiation
d) summing



6.53 An OP-AMP integrator is used to integrate the square wave shown. What must be the value of R to make the peak value of the triangular wave equal 150 volts?

a) 10 000 ohms
b) 16 667 ohms
c) 25 000 ohms
d) 33 333 ohms