UNIVERSITY OF MANITOBA

DEPARTMENT:	Electrical & Computer Engineering	DATE & TIME:	12th December 2011 at 9AM
COURSE NO:	ENG 1450	PAGE NO.:	1 of 12
COURSE TITLE:	Intro. Electrical & Computer Eng.	EXAMINATION:	Final (50%)
DURATION:	2 Hours	EXAMINERS:	C. Shafai/S. Sherif

INSTRUCTIONS:

- Do not remove the staple.
- Closed-book exam. No books/notes allowed.
- Electronic devices (such PDAs, iPods, etc.) are NOT allowed.
- Non-programmable calculators are allowed.
- This is a multiple choice examination and consists of 30 questions.
- Mark your answer in pencil on the bubble sheet provided.
- Return both this booklet and the bubble sheet at the end of the examination.
- No marks will be given for working on this booklet.
- Each correct answer has one mark and each wrong answer has zero marks.
- No negative marks for wrong answer.
- A formula sheet is provided on the last page.

STUDENT NUMBER

PRINT YOUR NAME IN FULL ON THIS LINE

SIGNATURE

A01 (Prof. Shafai) A02 (Prof. Sherif)

CIRCLE YOUR SECTION

SEAT NUMBER

Mark	
Out of	30

1 What does the halogen gas in a halogen incandescent lamp do?

A) Coats the tungsten filament and prevents it evaporating quickly.

B) Re-deposits evaporated tungsten back on the filament.

C) Cools the filament so it lasts longer.

D) Makes the light brighter by absorbing infrared light from the filament and converting it to visible light.

E) None of the above.

2 TDMA modulation in your cell phone operates by:

A) Breaking up the data transmission into small time duration data packets. The limited available frequencies can then be shared by many users.

B) Assigning each user their own individual frequency.

C) Coding the messages and sending over multiple frequencies.

D) Messages are sent using amplitude modulation.

E) Both C and D.

3 If the power of the component shown below is -7 W, then the voltage V is equal to…

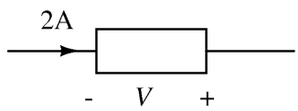
A) $+14$ V

B) -3.5 V

C) $+3.5$ V

D) -1.75 V

E) None of the above.



4 Using KCL, determine the current i_1 in the following circuit.

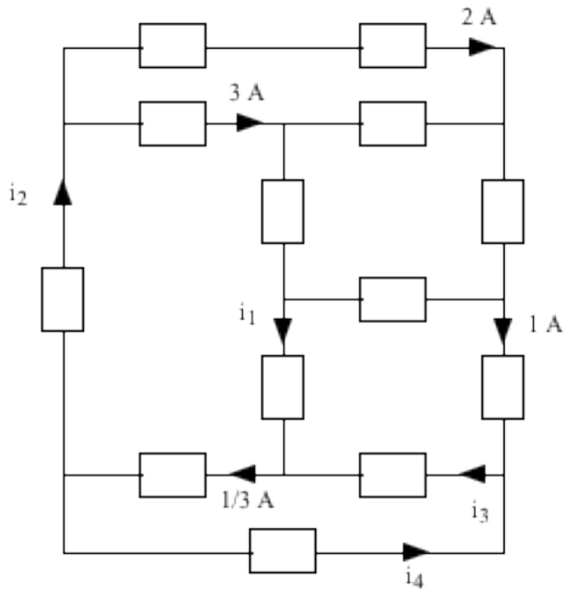
A) 6 A

B) 4 A

C) -2 A

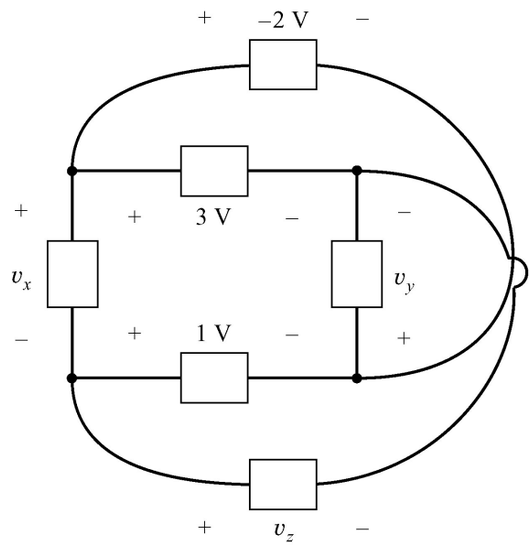
D) 8 A

E) None of the above.



5 What is the value of $v_x + v_z$ in the circuit shown below?

A) +2 V
B) –2 V
C) –3 V
D) +3 V
E) 0 V

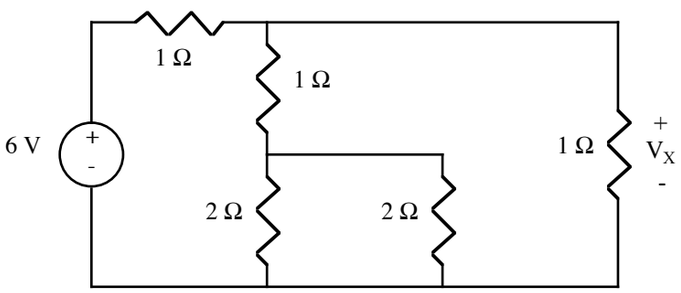


6 One of your professors drives to work tomorrow at 9 am, but leaves her lights on when she parks her car. Many students come to her office asking her questions all day about their final exam, and so she can't leave to turn her lights off until 3 pm. Her car's lights consume at total of 15 A, and the car battery is 12 V with a total storage capacity of 5 MJ of energy. Which of the following is true?

A) Her battery will have no charge when she gets to her car at the end of the day.
B) Her battery will only be ½ depleted by the end of the day.
C) The headlights will drain her battery of 3.9 MJ of energy by 3 pm.
D) The headlights will drain her battery of 650 kJ of energy by 3 pm.
E) Her battery will only be ¼ depleted by the end of the day.

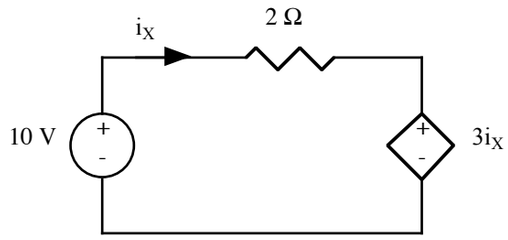
7 Determine V_X in the circuit?

A) 2.4 V
B) 3 V
C) 2 V
D) 3.6 V
E) 8 V



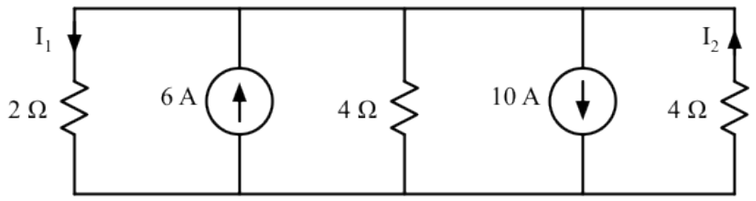
8 Determine i_X in the circuit.

A) 6 A
B) 5 A
C) 3.5 A
D) 2 A
E) -10 A



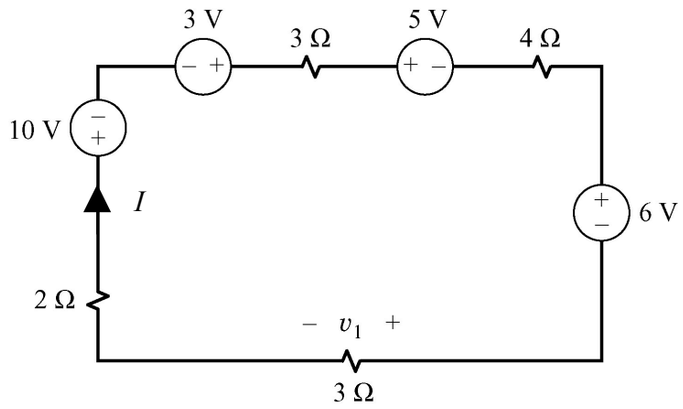
9 What are I_1 and I_2, respectively?

A) +2 A, +1 A
B) +2 A, –2 A
C) –1 A, –0.5 A
D) –2 A, +1 A
E) None of the above.



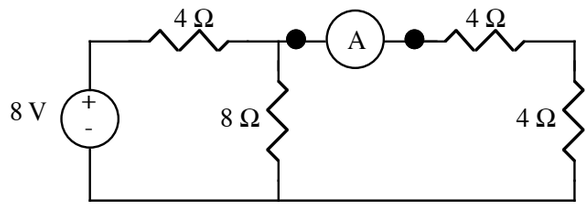
10 Which of the following is <u>correct</u> for the circuit shown below?

A) All four voltage sources deliver power.
B) The current of the loop, I, is 1.5 A.
C) The voltage v_1 is 4.5 V.
D) The power absorbed by any of the 3 Ω resistors 6.75 W.
E) None of the above.



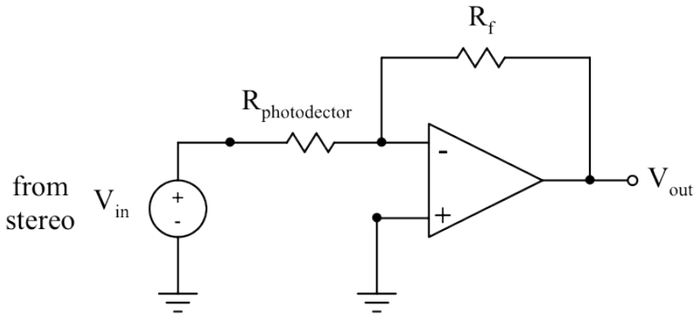
11 What is the current measured by the ammeter in the following circuit?

A) 0 A
B) 0.5 A
C) 1 A
D) 2 A
E) None of the above



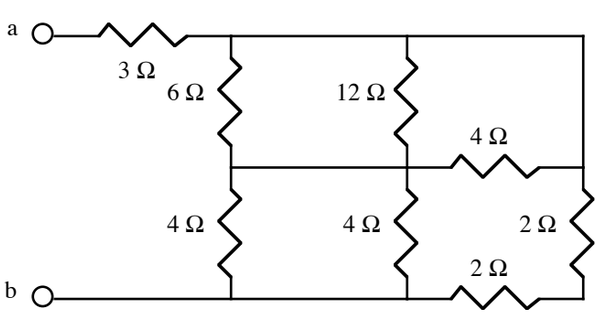
12 An ENG 1450 student wants to scare his roommate. He builds the following circuit, connects his stereo receiver as the input voltage to this amplifier, and connects the amplifier output to his speakers. He uses a photodetector for the input resistor of the amplifier. He puts his stereo in his roommate's bedroom, turns off the lights, and powers up his circuit. When his roommate enters his room, and turns on the lights, this sneaky ENG 1450 student wants the voltage powering the speakers to increase 100 times. if $R_{photodetector}$ = 10 kΩ when the lights are off, which of the following resistor choices would work for R_f and what should $R_{photodetector}$ become when the lights are turned on?

A) R_f = 1 kΩ and $R_{photodetector}$ = 1 kΩ
B) R_f = 1 kΩ and $R_{photodetector}$ = 10 kΩ
C) R_f = 20 kΩ and $R_{photodetector}$ = 200 Ω
D) R_f = 20 kΩ and $R_{photodetector}$ = 10 Ω
E) R_f = 10 kΩ and $R_{photodetector}$ = 100 Ω



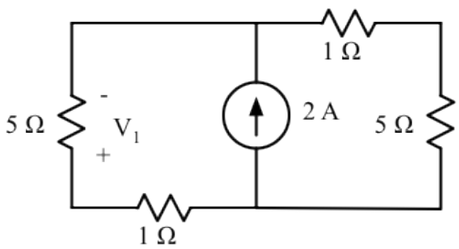
13 What is the equivalent resistance between terminals a and b?

A) 4.33 Ω
B) 8 Ω
C) 8.33 Ω
D) 5 Ω
E) 8.6 Ω



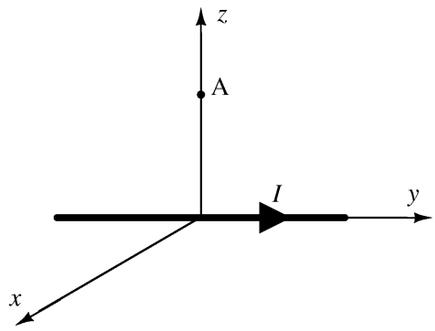
14 What is the voltage V_1 in the circuit shown below?

A) – 5 V
B) + 5 V
C) –10 V
D) +10 V
E) None of the above.



15 A wire carries an electric current, *I*, that is flowing in the +*y* direction as shown below. What is the direction of the magnetic field generated by this current at point A?

A) +y
B) +x
C) -x
D) +z
E) -*z*



16 In the circuit given below, we have $R_2 = 2R_1$ and $R_3 = 3R_1$, how much is the voltage across R_1?

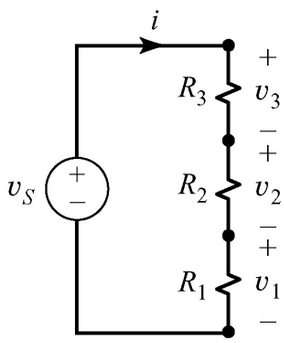
A) $v_1 = 5v_S$

B) $v_1 = \frac{1}{5}v_S$

C) $v_1 = \frac{1}{6}v_S$

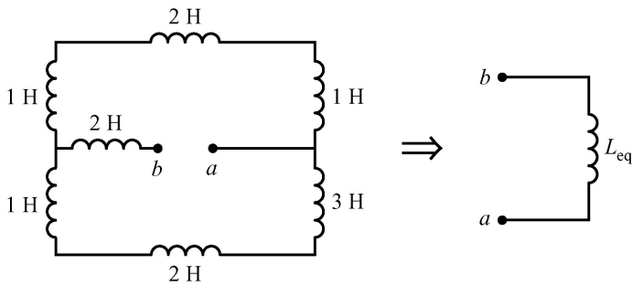
D) $v_1 = \frac{4}{5}v_S$

E) None of the above.



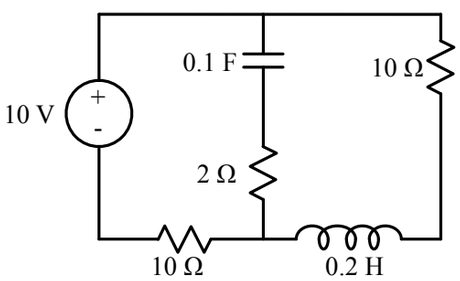
17 Determine the equivalent inductance L_{eq}.

A) L_{eq} = 2 H
B) L_{eq} = 2.4 H
C) L_{eq} = 4 H
D) L_{eq} = 4.4 H
E) None of the above



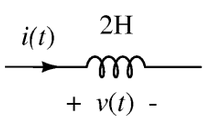
18 The circuit shown below has been connected for a long time. How much is the energy stored in the capacitor?

A) 5 J
B) 1.25 J
C) 2.5 J
D) 10 J
E) None of the above.



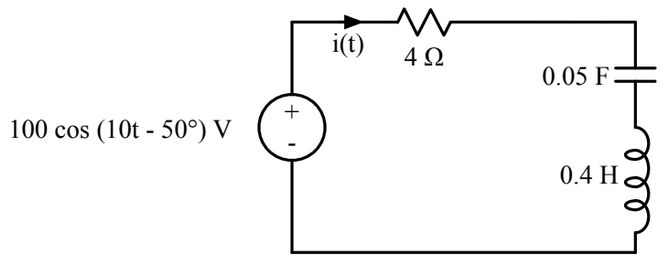
19 The current of a 2-H inductor is $i(t) = 10\cos(5t+30°)$. What is the voltage of the inductor?

A) $v(t) = 100\cos(2t + 120°)$ V
B) $v(t) = 10\cos(2t + 30°)$ V
C) $v(t) = 50\cos(2t + 30°)$ V
D) $v(t) = 10\cos(2t - 120°)$ V
E) None of the above.



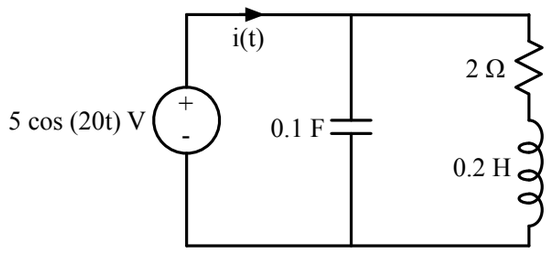
20 What is the current i(t) in this circuit?

A) i(t) = 25 cos(20t - 76.6º) A
B) i(t) = 25 cos(20t + 76.6º) A
C) i(t) = 16 cos(10t - 60º) A
D) i(t) = 22.4 cos(10t + 23.4º) A
E) i(t) = 22.4 cos(10t - 76.6º) A



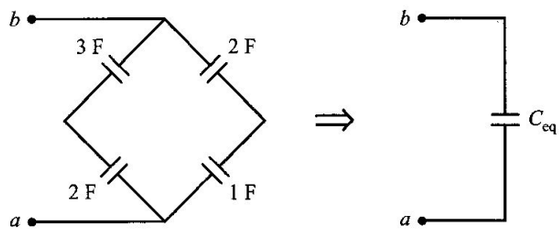
21 What is the current i(t) in this circuit?

A) i(t) = 5 cos(20t + 86.8º) A
B) i(t) = 9 cos(20t + 86.8º) A
C) i(t) = 5 cos(20t - 86.8º) A
D) i(t) = 7 cos(20t – 63.3º) A
E) i(t) = 12 cos(20t + 87.4º) A



22 Determine the equivalent capacitance C_{eq}.

A) C_{eq} = 1.875 F
B) C_{eq} = 2.22 F
C) C_{eq} = 1.8667 F
D) C_{eq} = 2 F
E) None of the above



23 The sampling frequency of an analog signal represents:

A) how often the amplitude of an analog signal is measured.
B) how accurate the amplitude of an analog signal is measured.
C) how high the bit-depth of an analog signal is represented.
D) how low the bit-depth of an analog signal is represented.
E) how accurate the phase of a sinusoidal signal is measured.

24 What is the binary representation of $(16AED12)_{16}$?

A) 101101010111010110000010010
B) 101101101111010111000010010
C) 101001010111010110100010010
D) 101111101111010110100110010
E) 101101010111010110100010010

25 In an 8 bit binary computer, the binary representation of $(-56)_{10}$ using 2's complement is given by

A) 11101000
B) 11101001
C) 11001000
D) 11101111
E) 10011011

26 An 8-bit computer that uses 2's complement is used to evaluate $(16)_{10} + (-56)_{10}$. Which of the following is stored by the computer as the answer?

A) 11011100
B) 11011000
C) 01111110
D) 00100010
E) None of the above.

27 Which of the following is the truth table for $z = x'y + x$?

A)

x	y	z
0	0	0
0	1	1
1	0	1
1	1	1

B)

x	y	z
0	0	1
0	1	0
1	0	0
1	1	1

C)

x	y	z
0	0	1
0	1	0
1	0	0
1	1	0

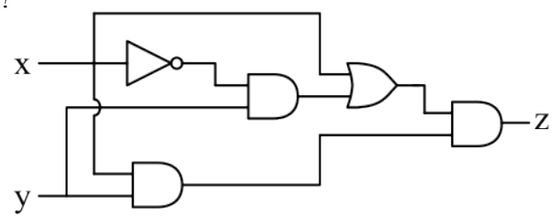
D)

x	y	z
0	0	0
0	1	0
1	0	0
1	1	1

E)

x	y	z
0	0	1
0	1	1
1	0	0
1	1	1

28 Which of the following describes the following digital circuit?



A) $z = (x' \cdot y + x') \cdot (x \cdot y)$

B) $z = (x' \cdot y) \cdot (x \cdot y)$

C) $z = (x' \cdot y + x) + (x+y)$

D) $z = (x' \cdot y + x) \cdot (x \cdot y)$

E) None of the above.

29 You need to record the vibration of a bridge with an accuracy of at least 1%. You connect the output of the analog vibration sensor on the bridge to an analog-to-digital (A to D) converter board, in order to record the data on your computer. If you need an accuracy of 1% in your data, what bit resolution (unsigned) does the A to D board need to be?

A) at least 10 bits

B) at least 8 bits

C) at least 6 bits

D) at least 7 bits

E) at least 4 bits

30 Describe the following using a Boolean logic function. We want to fire a football coach (by setting F=1) if he is mean (represented by M=1). If he is not mean, but has a losing season (L=1), we want to fire him anyway. Which of the following truth tables describes the function F?

A)

M	*L*	*F*
0	0	0
0	1	0
1	0	1
1	1	1

B)

M	*L*	*F*
0	0	0
0	1	1
1	0	0
1	1	1

C)

M	*L*	*F*
0	0	0
0	1	1
1	0	1
1	1	1

D)

M	*L*	*F*
0	0	1
0	1	1
1	0	0
1	1	1

E)

M	*L*	*F*
0	0	0
0	1	0
1	0	0
1	1	1

Formula Sheet

Ohm's law: $V = RI$

Power: $P = VI$

Voltage division: $V_k = \frac{R_k}{\sum R_i} V_S$

Current division: $I_k = \frac{\frac{1}{R_k}}{\sum \frac{1}{R_i}} I_S$

Resistors in series: $R_{eq} = \sum R_i$

Resistors in parallel: $\frac{1}{R_{eq}} = \sum \frac{1}{R_i}$

Capacitors in series: $\frac{1}{C_{eq}} = \sum \frac{1}{C_i}$

Capacitors in parallel: $C_{eq} = \sum C_i$

Inductors in series: $L_{eq} = \sum L_i$

Inductors in parallel: $\frac{1}{L_{eq}} = \sum \frac{1}{L_i}$

Energy stored in a capacitor: $W = \frac{1}{2} CV^2$

Energy stored in an inductor: $W = \frac{1}{2} LI^2$

Impedance of a capacitor: $Z_C = \frac{1}{j\omega C}$, where $\omega = 2\pi f$

Impedance of an inductor: $Z_L = j\omega L$, where $\omega = 2\pi f$