جامعة بيرزيت

BIRZEIT UNIVERSITY

Physics 112

Final Exam
Time: 2.00 Hours

2nd sem. 2012/2013
Date: 12/5/2013

Student Name: _____ Student No.: _____
Section: _____

Instructor: (1, 7, 8, 10, 11,13, 14) Izzat (3, 4, 12) Badran
(2) Andoni (5, 9) Hidmi (6) Sader

(Note: The total number of questions is 30)

تعليمات:

1) لا تفتح ورقة الامتحان حتى يسمح لك بذلك.
2) اكتب اسمك ورقمك في أعلى هذه الصفحة.
3) اختر الجواب الأكثر قربا للجواب الصحيح وانقله على هذه الصفحة، وذلك بوضع إشارة (X) في الخانة المناسبة.
4) السؤال الذي له أكثر من إجابة يعطى علامة صفرا.
5) يجب إعادة أوراق الامتحان كاملة.

No.	A	B	C	D	E
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No.	A	B	C	D	E
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1) In experiment 1 you study the I-V characteristics for three circuit components. In the figures below different I-V characteristic curves are shown.

Fig.1

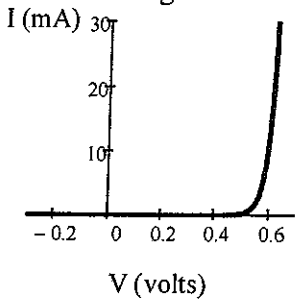


Fig.2

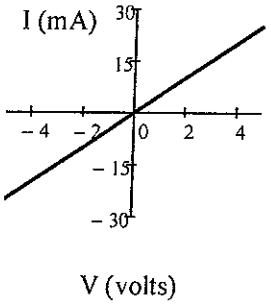
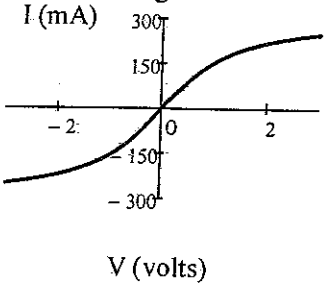


fig.3



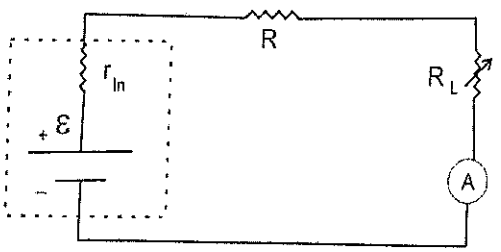
Choose the correct statement:

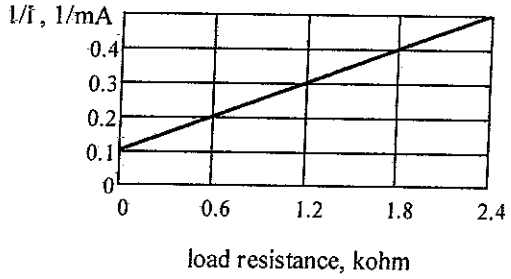
A) Figure 1 represents the I-V characteristic of the light bulb. It is symmetric; the current flowing for a given voltage is the same regardless of polarity but changes direction with the sense of the polarity of the voltage and it is nonlinear because the temperature of the tungsten filament varies from 20^0C to 3000^0C.
B) Figure 1 represents the I-V characteristic of the Si-diode. It is not a straight line and the resistance depends on the voltage and the current is almost zero if polarity of the voltage is reversed.
C) Figure 1 represents the I-V characteristic of the carbon resistor. It is a straight line and the resistance depends on the voltage.
D) Figure1 represents the I-V characteristic of the light bulb. It is linear because the temperature of the tungsten filament varies from 20^0C to 3000^0C.
E) Figure 1 represents the I-V characteristic of the carbon resistor. It is clear that the carbon resistor is ohmic conductor with constant resistance about 200Ω.

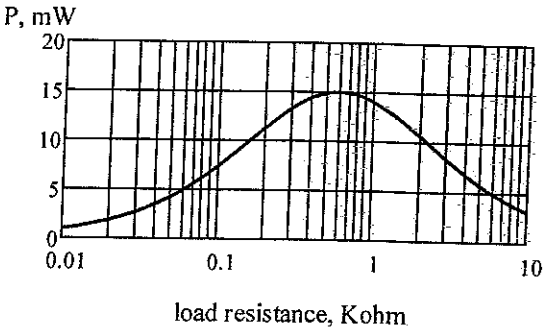
2) The thermal coefficient of resistivity for tungsten is 4.5×10^{-3} $°C^{-1}$. If the resistance of the tungsten wire in a light bulb is 2 Ω at 20 °C, then its resistance at a temperature of 1720 °C will be about:

A) 2 Ω.
B) 6.5 Ω.
C) 12 Ω.
D) 17 Ω.
E) 23 Ω.

In experiment 2 you connected the circuit shown in order to study source internal resistance and impedance matching.
If one take the reading of the ammeter while changing the value of R_L, then plot 1/I versus R_L and on a semi-log graph paper plot the power consumed in the load as a function of the load $P(R_L)$ as shown in the graphs below.







Then answer the following 3 questions.

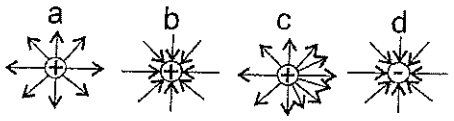
3) The value of the electromotive force used is about:

A) 8 volts
B) 10 volts
C) 20 volts
D) 5 volts
E) 6 volts

4) The maximum power delivered to the load resistance is about:
A) 12.5 mW when R_L is about 0.5 kΩ.
B) 12.5 mW when R_L is about 1 kΩ.
C) 12.5 mW when R_L is about 2 kΩ
D) 15 mW when R_L is about 0.6 kΩ
E) 20 mW when R_L is about 0.8 kΩ

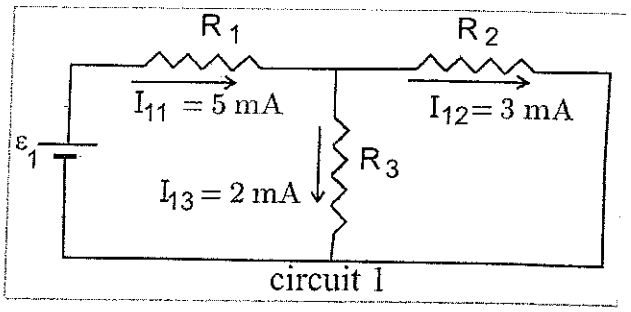
5) The value of the additional resistance R used is about:
A) 2 kΩ
B) 1 kΩ
C) 0.5 kΩ
D) 0.6 kΩ
E) 0.8 kΩ

6) Several electric field lines patterns for point charges are shown in the figure below. Which of these patterns are incorrect and why?



A) Pattern b because the lines directed towards a positive charge.
B) Pattern c because the lines are not symmetrically positioned.
C) Pattern b because the charge negative and pattern c because there are more lines than the other charges.
D) Pattern b because the lines directed towards a positive charge and pattern c because the lines are not symmetrically positioned.
E) All the patterns are correct.

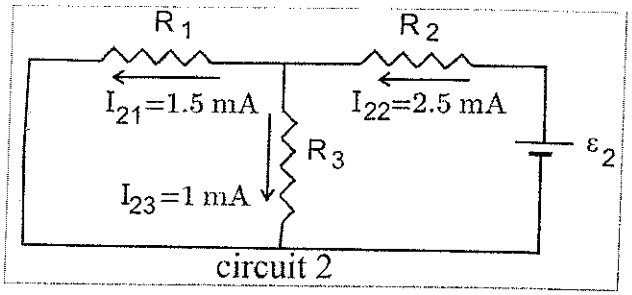
Consider the three circuits shown below and answer the following three questions. ($R_1 = R_2 = 1$ kΩ)



circuit 1

7) The value of current I_1 in circuit 3 is:

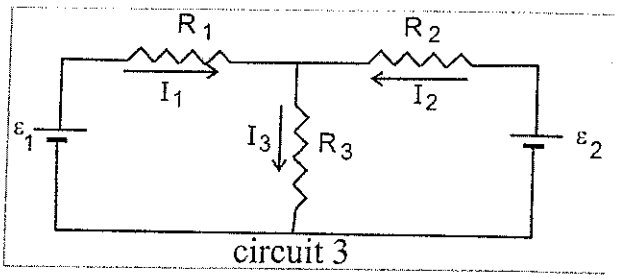
A) 0.5 mA clockwise
B) 3.5 mA clockwise
C) 3 mA counterclockwise
D) 5.5 mA counterclockwise
E) 6.5 mA clockwise.



circuit 2

8) The value of ε_2 is:

A) 4 volts
B) 10.5 volts
C) 12 volts
D) 6 volts
E) 8 volts

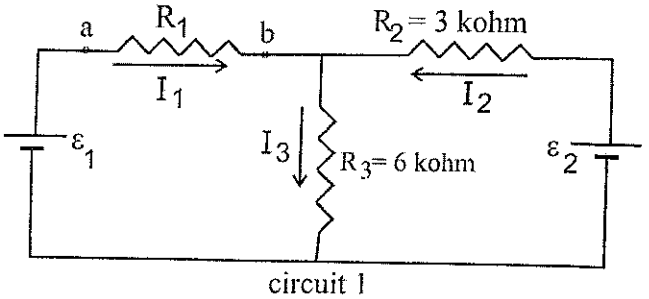


circuit 3

9) R_3 equals:

A) 6.2 kΩ
B) 3 kΩ
C) 1.5 kΩ
D) 4.5 kΩ
E) 2 kΩ

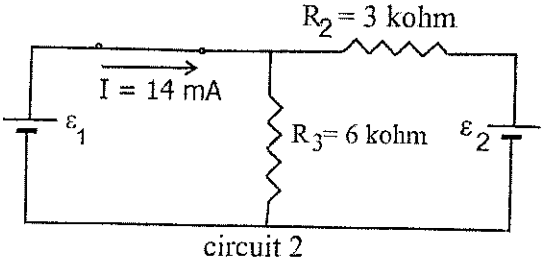
Consider the four circuits shown and using Thevenin and Norton techniques answer the following three questions. ($R_1 = 5$ kΩ)



circuit 1

10) The value of I_1 passing through R_1 in circuit 1 is:

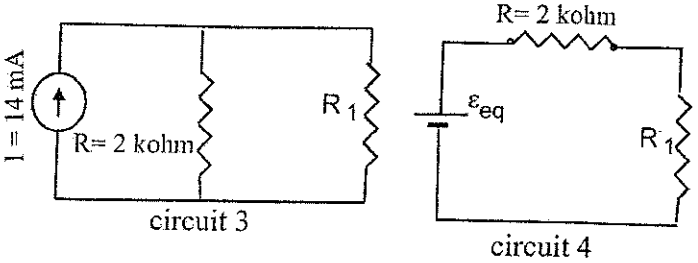
A) 0.5 mA
B) 7 mA
C) 4 mA
D) 10 mA
E) None of the above



circuit 2

11) The value of ε_{eq} in circuit 4 is:

A) 12 volts
B) 8 volts
C) 6 volts
D) 28 volts
E) None of the above

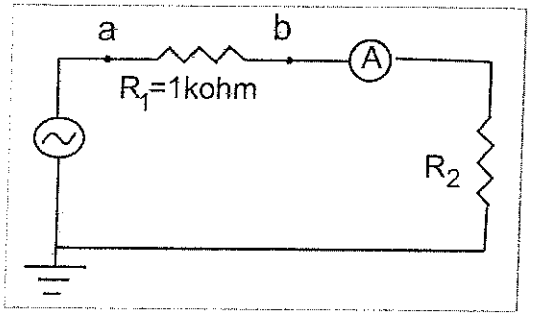


12) To measure the value of the Thevenin equivalent voltage (ε_{eq}), if the output terminals are points **a** and **b** in circuit1 :

A) You connect the voltmeter between points **a** and b.
B) You remove R_3, then exchange the batteries ε_1 and ε_2 with shorts then measure the voltage between points **a** and **b**.
C) You remove R_1 then connect a voltmeter in place of ε_1.
D) You remove R_1, then connect the voltmeter between points **a** and **b.**
E) None of the above.

The reading of the DMM connected in the circuit as shown is 10 mA.
Using the oscilloscope the peak voltage at point (a) found to be 21.2 volts.
Answer the following two questions.

13) The value of R_2 is about:

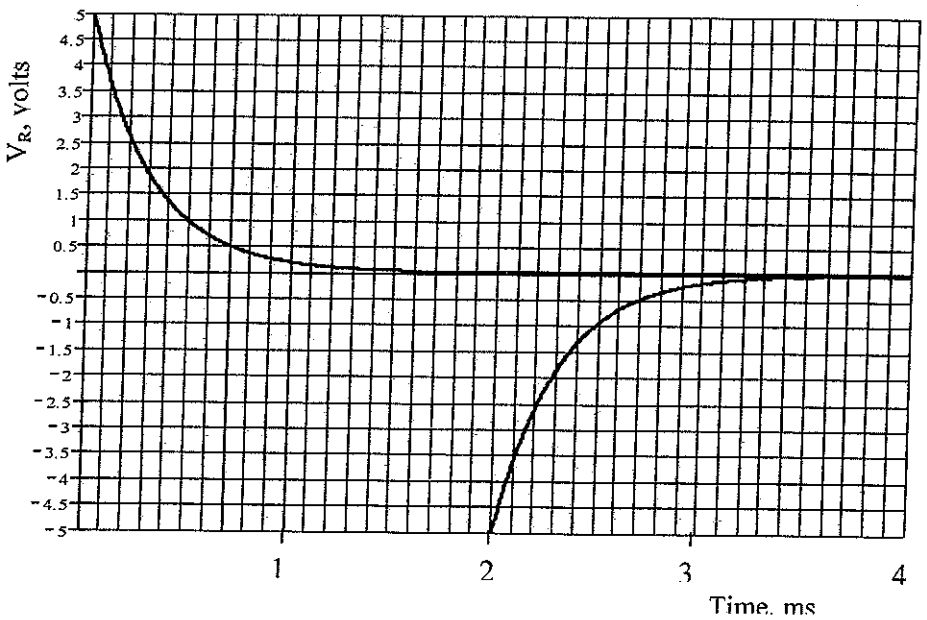


A) 2 kΩ
B) 0.5 kΩ
C) 5 kΩ
D) 3.2 kΩ
E) 7.5 kΩ

14) The RMS voltage on R_1 is about:

A) 15 volt
B) 30 volt
C) 5 volt
D) 10 volt
E) None of the above.

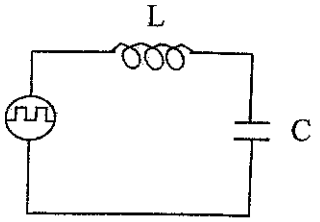
15) Consider RC circuit powered using a square wave from the signal generator. The figure below represents the voltage on the resistor V_R displayed on the DSO screen.



If the capacitance C= 0.3 μF, then using the figure the value of the resistance is:

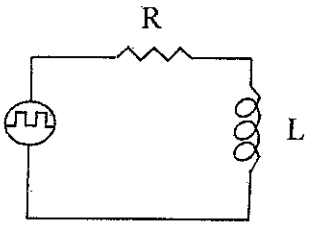
A) 3 kΩ
B) 1 kΩ
C) 150 Ω
D) 2 kΩ
E) 50 Ω

16) For the LC circuit shown, if L =4 mH and C = 0.4 μF . Then the maximum Vc will occur if the drive frequency is:



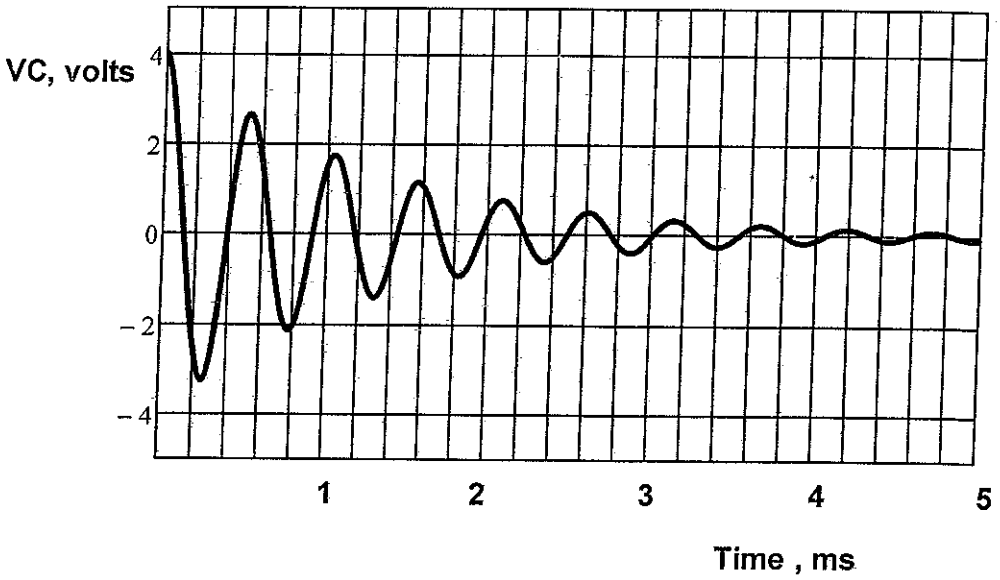
A) 3.2 kHz
B) 0.32 kHz
C) 0.4 kHz
D) 4 kHz
E) Has nothing to do with the drive frequency

17) Consider the RL-circuit shown below, the time dependence of the current through the resistor for this circuits is:



A) $I(t) = \frac{\varepsilon}{R} e^{Rt/L}$
B) $I(t) = \frac{\varepsilon}{R}(1 - e^{-Rt/L})$
C) $I(t) = \frac{\varepsilon}{R} e^{-Rt/2L})$
D) $I(t) = \frac{\varepsilon}{R}(1 - e^{-Lt/R})$
E) None of the above.

For an RLC circuit powered by a square wave, the voltage on the capacitor Vc is shown in the figure below. If L =10 mH then use the information in the Vc vs. time curve to answer the following <u>three questions</u>.



18) Assuming ideal components the value of R in Ω is about:

A) 600
B) 3.2
C) 16
D) 64
E) 1200

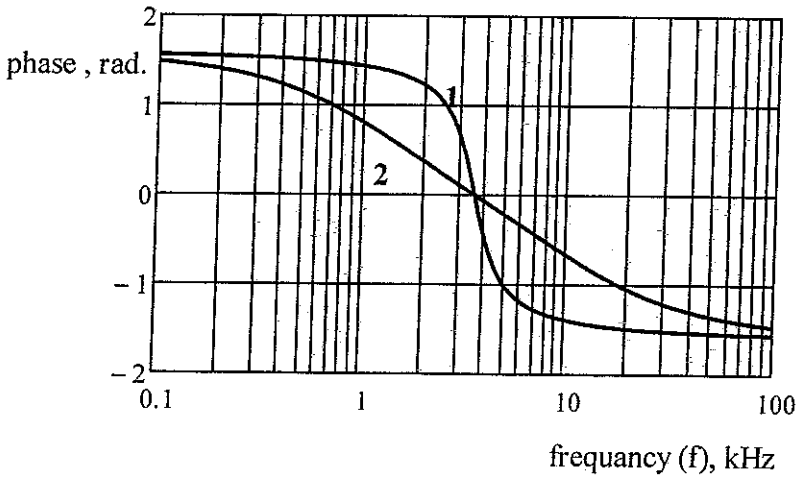
19) The value of the capacitance C in μF is about:

A) 0.7
B) 0.2
C) 0.01
D) 20
E) 3.5

20) If the value of the capacitance C=2 μF, then the state of critical damped oscillation will occur if the resistance R is about:

A) 557 Ω
B) 2240 Ω
C) 63 Ω
D) 141 Ω
E) 283 Ω

In a series RLC circuit driven by sinusoidal input signal, the phase between the current and the input voltage is plotted in the next graph for two different values of the circuit components (curve1 and curve2). Use the graph to answer the following four questions



21) Choose the correct statement:

A) $L_1=L_2$ and $R_1=R_2$ but $C_1<C_2$
B) $L_1=L_2$ and $C_1=C_2$ but $R_1<R_2$
C) $C_1=C_2$ and $R_1=R_2$ but $L_1<L_2$
D) $L_1=L_2$ and $C_1=C_2$ but $R_1>R_2$
E) It is impossible to know.

22) The resonance for curve 1 occurs at frequency:

A) 2 kHz
B) 1.5 kHz
C) 5 kHz
D) 2.5 kHz
E) 3.6 kHz

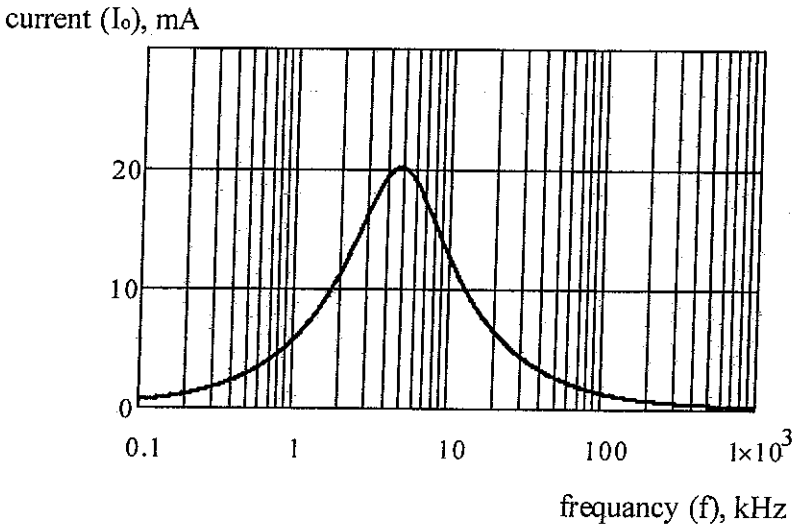
23) At frequency of the driven voltage f = 10 kHz the phase between the current and the input voltage for curve 2 is about:

A) -1 rad.
B) -0.7 rad.
C) -1.2 rad.
D) -1.5 rad.
E) zero.

24) For curve 1, If the capacitance $C_1 = 0.2\ \mu F$ and the resistance $R_1 = 100\ k\Omega$ then the inductance in the circuit is about:

A) 20 mH
B) 10 mH
C) 30 mH
D) 5 mH
E) Non of the above.

For a series RLC circuit with a sinusoidal input voltage, the amplitude of the current passing through the circuit (I_0) is plotted as a function of frequency in the next graph below.



Using the information from the graph answer the following <u>three questions</u>:

25) The value of the resonance frequency is about;

A) 22.5 kHz
B) 10.5 kHz
C) 1 kHz
D) 15.2 kHz
E) 4.8 kHz

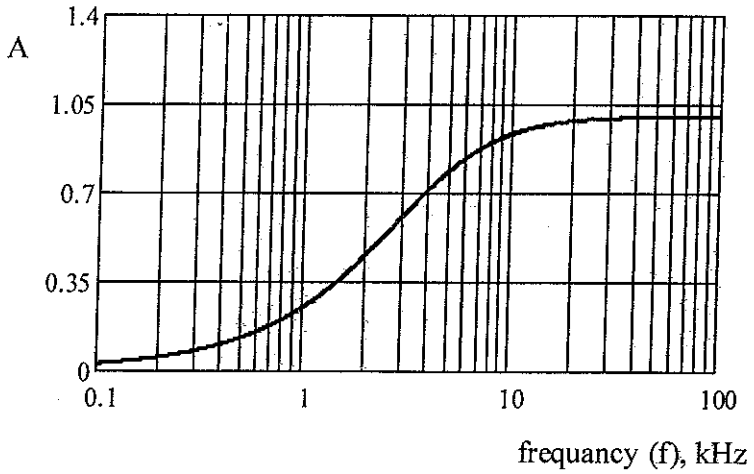
26) If the input voltage is given by $V_{in}=4\sin(\omega t+\varphi)$ then the value of R is about:

A) 800 Ω
B) 200 Ω
C) 500 Ω
D) 1 kΩ
E) 2 kΩ

27) If L= 5 mH and C= 0.022 μF then the quality factor Q is about:

A) 1.4
B) 2
C) 0.3
D) 0.6
E) 0.8

For RC filter circuit the attenuation factor as a function of frequency is plotted in the graph below. Using the information from the graph answer the following <u>three questions:</u>



28) The value of ω_{-3db} is about:

A) 12 krad/s
B) 19 krad/s
C) 25 krad/s
D) 31 krad/s
E) Non of the above

29) If the value of the peak voltage at the resistor at f = 40 kHz is 4 volts, then the value of the peak voltage for the input is about

A) 2 volt
B) 3 volt
C) 4 volt
D) 5 volt
E) 6 volt

30) If the input signal is Triangular in shape, then the shape of the output signal at f = 400 Hz must be

A) Sinusoidal
B) Triangular
C) Square
D) Pure damping (always decaying)
E) Sinusoidal oscillations accompanied by decaying

Good Luck