Yıldız Technical University
Computer Engineering Department
2019-2020 Academic Year
Spring Semester
BLM1612 Circuit Theory
Take Home Quiz, Form: A

Name: _____

Surname: _____

Student I.D.: _____

Signature: _____

Announcement Time: **17:00 30/April/2020**
Due Time: **08:59 04/May/2020**
Submission: Email your work, scanned (either with scanner or phone) to a **single PDF file** named as ⟨*group no*⟩ _ ⟨*student id*⟩ *.pdf*
to **ytudonanim@gmail.com** if you are in Gr.1 and
to **hamzailhan6@gmail.com** if you are in Gr.2,
with **20192_BLM1612_homework** subject field. (Ex. file name gr1_19011000.pdf)
You must **show all of your work** for full credit.
A correct answer with nowork shown is worth no points.
Use the **methods mentioned in questions** for your answers.

Section 1. Circuit Elements and Simple Resistive Circuits

1. Which quantity consists of a unit 1KWh ?
   (a) Time
   (b) Power
   (c) Energy
   (d) Charge
   (e) None of the above

2. A piece of resistive material has a length of $10mm$, a cross sectional area of $7mm^2$ and a resistivity of $4700 \times 10^{-8}\Omega \cdot m$. What is its resistance?
   (a) $67\mu\Omega$
   (b) $67m\Omega$
   (c) 30.4Ω
   (d) $30.4k\Omega$
   (e) None of the above

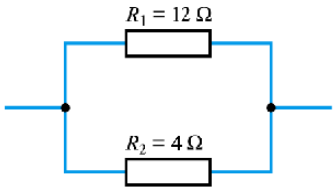
3. The internal conductance of ideal voltage source is
   (a) Infinite
   (b) Zero
   (c) Equal to internal resistance
   (d) Equal to external collector
   (e) None of the above

4. Calculate the effective resistance of the following combination.

   (a) 22Ω
   (b) 32Ω
   (c) 42Ω
   (d) 52Ω
   (e) None of the above

5. Which of the followings is/are active element?
   (a) Voltage source
   (b) Current source
   (c) Both a and b
   (d) Capacitor
   (e) None of the above

6. Calculate the effective resistance of the following combination.

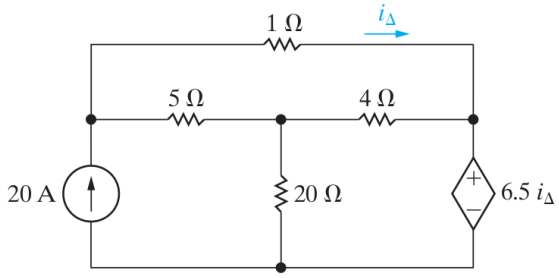


   (a) 3Ω
   (b) 6Ω
   (c) 8Ω
   (d) 16Ω
   (e) None of the above

7. The internal resistance of ideal current source is
   (a) Infinite
   (b) Zero
   (c) Equal to internal conductance
   (d) 100Ω
   (e) None of the above

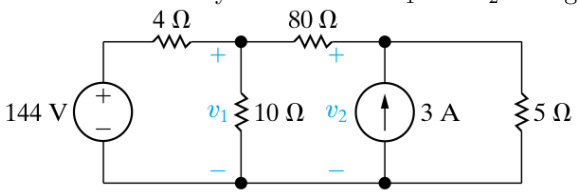
Section 2. Circuit Analysis Techniques

8. Use the mesh analysis to find the power dissipated by the independent current source.



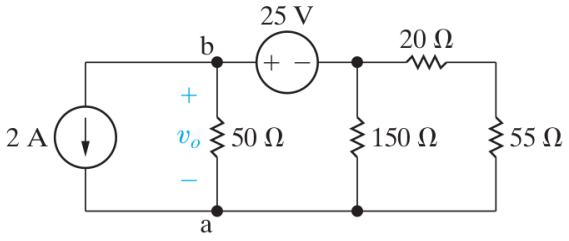
(a) $120W$
(b) $1560W$
(c) $2400W$
(d) $960W$
(e) None of the above

9. Use the nodal analysis to find the v_1 and v_2 voltages.



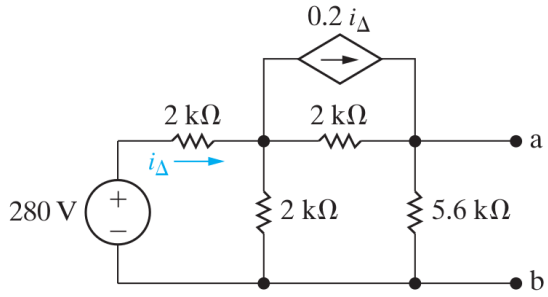
(a) $v_1 = 100.00V$, $v_2 = 20.00V$
(b) $v_1 = 99.02V$, $v_2 = -8.29V$
(c) $v_1 = 100.00V$, $v_2 = -20.00V$
(d) $v_1 = -99.02V$, $v_2 = 8.29V$
(e) None of the above

10. Use the nodal analysis to find the v_0. Use node a as the reference node.



(a) $37.50V$
(b) $-37.50V$
(c) $-62.50V$
(d) $-100.00V$
(e) None of the above

11. Find the Norton equivalent current (I_N) and Norton equivalent resistance (R_N) of the given circuit with respect to terminals a and b.



(a) $I_N = 60mA,\ R_N = 1866.67\Omega$

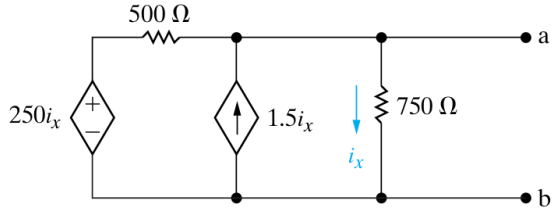
(b) $I_N = 260mA,\ R_N = 430.77\Omega$

(c) $I_N = 32.31mA,\ R_N = 3466.67\Omega$

(d) $I_N = 210mA,\ R_N = 533.33\Omega$

(e) None of the above

12. Find the Norton equivalent current (I_N) and Norton equivalent resistance (R_N) of the given circuit with respect to terminals a and b.



(a) $I_N = 3A,\ R_N = 1.5k\Omega$

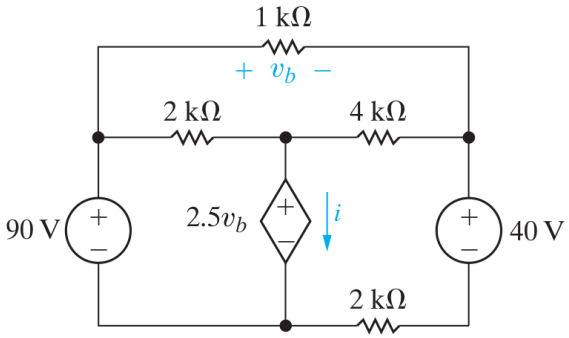
(b) $I_N = 0A,\ R_N = 1.5k\Omega$

(c) $I_N = 0A,\ R_N = 750\Omega$

(d) $I_N = 3A,\ R_N = 750\Omega$

(e) None of the above

13. Use the principle of superposition to find the current i.



(a) $7.11mA$

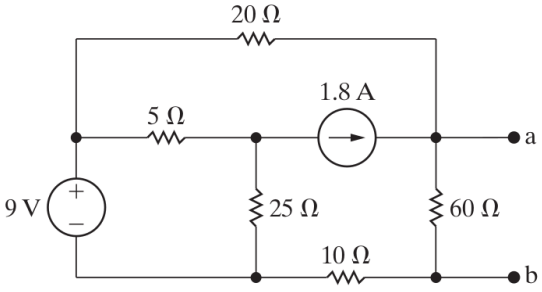
(b) $17.89mA$

(c) $25.00mA$

(d) $15.00mA$

(e) None of the above

14. Find the Thévenin equivalent voltage (V_{TH}) and Thévenin equivalent resistance (R_{TH}) of the given circuit with respect to terminals a and b.



(a) $V_{TH} = 30V$, $R_{TH} = 30\Omega$

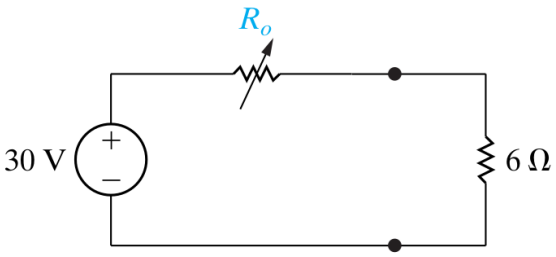
(b) $V_{TH} = 35V$, $R_{TH} = 23.33\Omega$

(c) $V_{TH} = 20V$, $R_{TH} = 30\Omega$

(d) $V_{TH} = 30V$, $R_{TH} = 20\Omega$

(e) None of the above

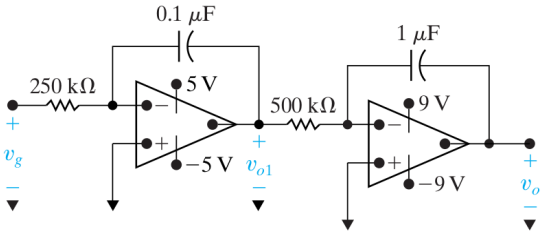
15. What is the maximum power that can be delivered to the 6Ω resistor using the variable resistor R_0?



(a) $37.5W$
(b) $70W$
(c) $150W$
(d) $300W$
(e) None of the above

Section 3. Operational Amplifier

16. No energy is stored in the circuit given when the input voltage v_g jumps instantaneously from 0 to $25mV$ at time $t = 0$. Drive the expression for $v_0(t)$ for $0 \leq t \leq t_{sat}$ (t_{sat} is the time required for any op amp to reach saturation).



(a) $v_0(t) = t^2$

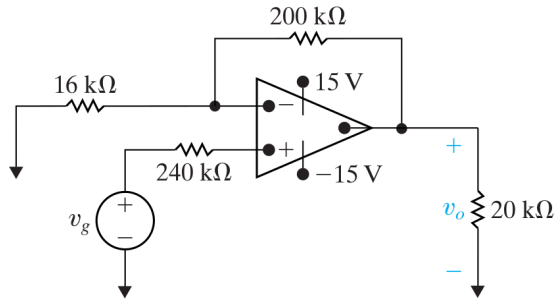
(b) $v_0(t) = 2t$

(c) $v_0(t) = 2$

(d) $v_0(t) = 0$

(e) None of the above

17. The op amp in the noninverting amplifier circuit given has an input resistance of $560k\Omega$, an output resistance of $8k\Omega$, and an open-loop gain of $50,000$. Assume that the op amp is operating in its linear region. Calculate the voltage gain $\left(\frac{v_o}{v_g}\right)$.



(a) 1

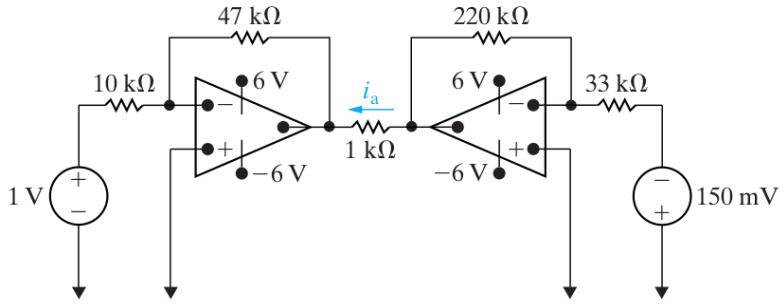
(b) 2

(c) 6.75

(d) 13.49

(e) None of the above

18. The op amps in the circuit given are ideal. Find i_a.



(a) $0mA$

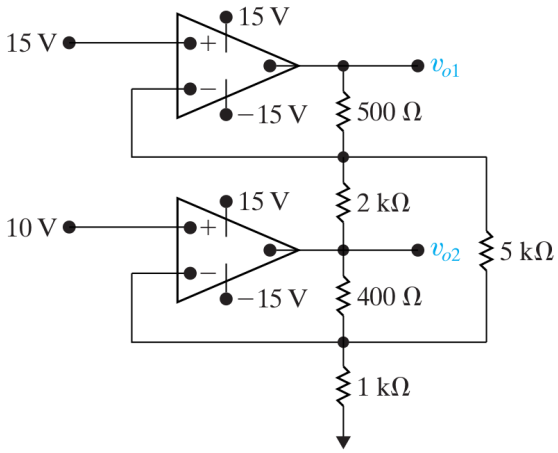
(b) $3.7mA$

(c) $5.7mA$

(d) $7.7mA$

(e) None of the above

19. The two op amps are ideal in the given circuit. Calculate v_{o1} and v_{o2}.



(a) $v_{o1} = 9.10V$ and $v_{o2} = 13.60V$

(b) $v_{o1} = 15.85V$ and $v_{o2} = 13.60V$

(c) $v_{o1} = 14.75V$ and $v_{o2} = 16.00V$

(d) $v_{o1} = 15.00V$ and $v_{o2} = 10.00V$

(e) None of the above

Section 4. Capacitor, Inductor and RL/RC Circuits

20. The current in a $150mH$ inductor is known to be $i_L = 25te^{-500t}A$ for $t \geq 0$. Find the energy stored in the inductor at $5ms$.

    (a) $4.74\mu J$

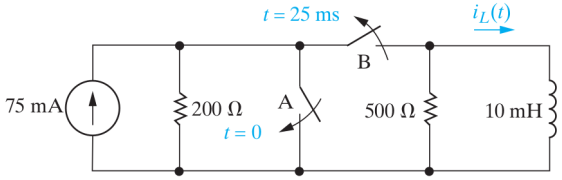
    (b) $7.9nJ$

    (c) $10.26mJ$

    (d) $461.73\mu J$

    (e) None of the above

21. In the circuit given, switch A has been open for a long time and switch B has been closed for a long time. At $t = 0$ the switch A closes. $25ms$ after switch A closes, switch B opens. Determine $i_L(t)$ for $t \geq 25ms$.



    (a) $i_L(t) = 75e^{-50000(t-0.025)}mA$

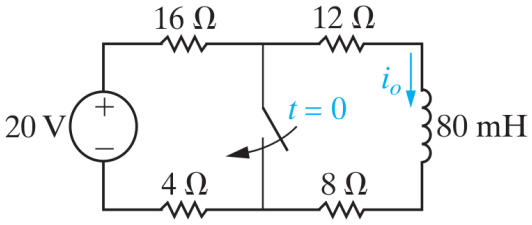
    (b) $i_L(t) = 50e^{-50000(t-0.025)}mA$

    (c) $i_L(t) = 50e^{-20(t-0.025)}mA$

    (d) $i_L(t) = 75e^{-20(t-0.025)}mA$

    (e) None of the above

22. The switch in the given circuit has been open for a long time. At $t = 0$ the switch is closed. Determine $i_0(t)$ for $t \geq 0$.



    (a) $i_0(t) = 0.17e^{-250t}A$

    (b) $i_0(t) = 0.5e^{-500t}A$

    (c) $i_0(t) = 0.5e^{-250t}A$

    (d) $i_0(t) = 0.17e^{-500t}A$

    (e) None of the above

23. A capacitor has plates $15mm \times 30mm$ which have separation of $10\mu m$. If the gap between the plates filled with air, calculate the capacitance of the device.

(a) $400pF$

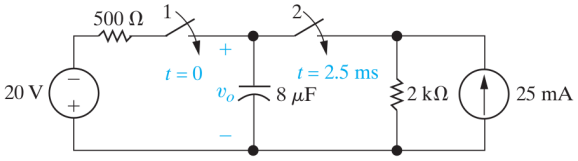
(b) $400nF$

(c) $400\mu F$

(d) $400mF$

(e) None of the above

24. There is no energy stored in the capacitor in the circuit given. Switch 1 closes at $t = 0$. Switch 2 closes at $2.5ms$. Find $v_0(t)$ for i) $0 \leq t < 2.5ms$ and ii) $t \geq 2.5ms$.



(a) $v_0(t) = \begin{cases} -20 + 20e^{-4t}V & ,0 \leq t < 2.5ms \\ -4 - 3.29e^{-2.4(t-0.0025)}V & ,t \geq 2.5ms \end{cases}$

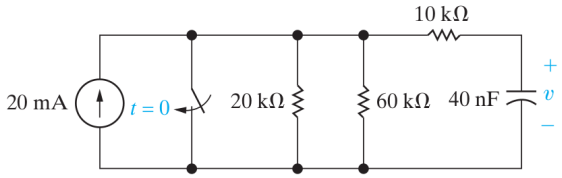
(b) $v_0(t) = \begin{cases} -20 + 20e^{-4t}V & ,0 \leq t < 2.5ms \\ -6 - 3.29e^{-312.5(t-0.0025)}V & ,t \geq 2.5ms \end{cases}$

(c) $v_0(t) = \begin{cases} -4 + 4e^{-250t}V & ,0 \leq t < 2.5ms \\ -6 - 4.14e^{-312.5(t-0.0025)}V & ,t \geq 2.5ms \end{cases}$

(d) $v_0(t) = \begin{cases} -20 + 20e^{-250t}V & ,0 \leq t < 2.5ms \\ -6 - 3.29e^{-312.5(t-0.0025)}V & ,t \geq 2.5ms \end{cases}$

(e) None of the above

25. The switch in the given circuit has been open for a long time. At $t = 0$ the switch is closed. Determine $v(t)$ for $t \geq 0$.



(a) $v(t) = 120e^{-277.78t}V$

(b) $v(t) = 300e^{-1000t}V$

(c) $v(t) = 300e^{-277.78t}V$

(d) $v(t) = 120e^{-1000t}V$

(e) None of the above