College of Industrial Technology
King Mongkut's University of Technology North Bangkok

Final Examination of Semester 1

Subject: 341151 Electric Circuits I

Date: 11 December 2015

Year: 2015

Section: 5 - 6

Time: 10.00 - 12.00

Name:_____ ID:_____ Class:_____

Instructions:

1. Cheating will result in failure of all classes registered for the current semester. Students who are caught on cheating will also be denied registering for the following semester.
2. No documents are allowed to be taken out of the examination room.
3. Text books and dictionaries are **NOT** allowed.
4. A calculator is allowed.
5. Electronic communication devices are **NOT** allowed in the examination room
6. The examination has 11 pages (including this page), 3 parts (50 questions) and a total score of 90 points.
7. Write all your answer on this examination sheet.

<u>Part 1</u> (20 points) True/False

Instruction: Mark "True" or "False" for the following questions in **THE PROVIDED ANSWER SHEET (SEE LAST PAGE)**.

1. The bridge network is said to be balanced when the current in the middle of bridge is zero.
2. Capacitance is directly proportional to the distance between the plates and inversely proportional to the area of the plates.
3. The total capacitance of several capacitors connected in series equals the sum of the individual capacitances.
4. The unit of inductor is named after Michael Faraday.
5. An ideal inductor looks like a short circuit to dc current.
6. Direction of magnetic flux line around conductor with current flow can be determined by right hand rule.
7. The total inductance of several coils in parallel equals the sum of the individual inductances.
8. A load will receive maximum power from a linear bilateral dc network when its total resistive value is exactly equal to the Norton resistance of the network as "seen" by the load.
9. Variables in mesh analysis are in the form of voltage.
10. Supermesh is happened if there is current source in branch.
11. The variables for nodal analysis are in voltage form.
12. For nodal analysis, Kirchhoff's current law is used.
13. R_N from Norton theorem is not the same as R_{Th} from Thevenin theorem.
14. Norton's equivalent circuit has a current source connected in series with a resistor.
15. An ideal voltage source has infinite internal resistance.
16. The current supplied by an ideal current source is independent from the load.
17. An ideal current source has zero resistance in series with it.
18. Short circuit between terminals is equivalent to zero voltage.
19. When using the superposition theorem, each ideal current source must be replaced by a short circuit.
20. Thevenin's equivalent circuit is consisting of a voltage source and a series resistor.

Part 2 (50 points) Multiple choices

Instruction: Mark the correct answer for the following questions in THE PROVIDED ANSWER SHEET.

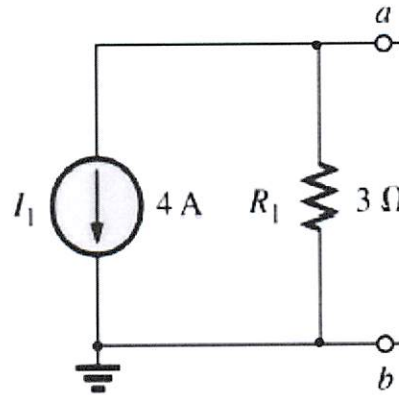1. Convert the current source to a voltage source.

Figure 1.

(A) 12 V and 3 Ω (B) 4 V and 3 Ω (C) 12 V and 4/3 Ω (D) 4 V and 4/3 Ω

2. From below, what is the determinant?

$$\begin{vmatrix} 3 & 4 \\ -1 & 20 \end{vmatrix}$$

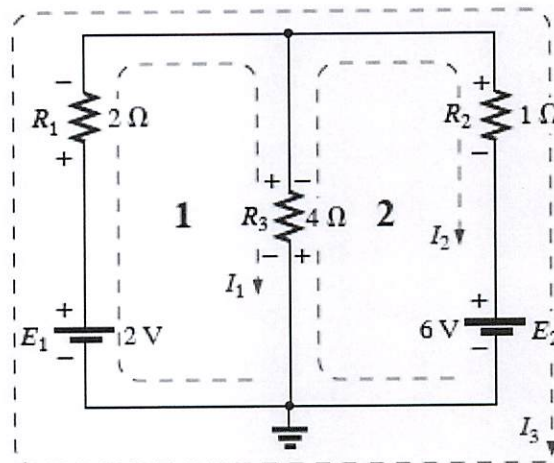(A) −64   (B) −56   (C) 56   (D) 64

Figure 2.

3. See Figure 2. Which of the following terms describes the voltage across the 4 Ω resistor when using the mesh analysis (general) approach?

(A) $(4\ \Omega)\, I_1$ (B) $(4\ \Omega)\,(I_2 - I_1)$ (C) $(4\ \Omega)\,(I_1 - I_2)$ (D) $(4\ \Omega)\,(I_1 + I_2)$

4. See Figure 2. The equation obtained from performing mesh analysis on mesh #2 is:

   (A) $6 - I_2 - 4(I_2 - I_1) = 0$

   (B) $6 + I_2 + 4(I_2 - I_1) = 0$

   (C) $6 + I_2 - 4(I_2 - I_1) = 0$
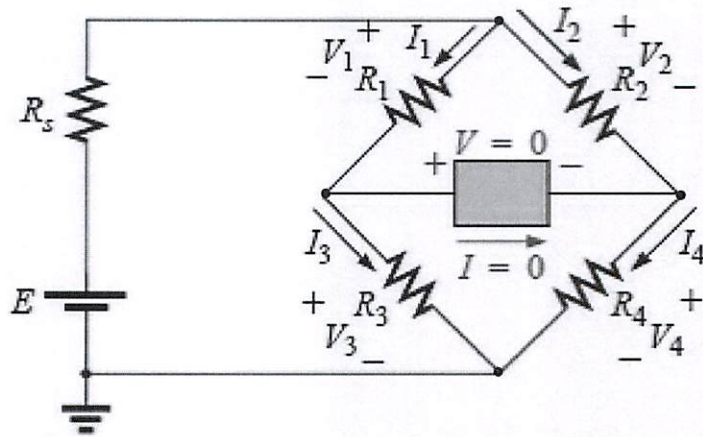
   (D) $6 - I_2 + 4(I_2 - I_1) = 0$

Figure 3.

5. From Figure 3 below, what is the condition of balance bridge ?

   (A) $R_2 / R_1 = R_3 / R_4$

   (B) $R_1 R_2 = R_3 R_4$

   (C) $R_1 / R_3 = R_2 / R_4$

   (D) $R_1 R_3 = R_2 R_4$

6. What the following is correct when all three resistors in star network are equal?

   (A) $R_\Delta = 3R_Y$

   (B) $R_\Delta = 3/R_Y$
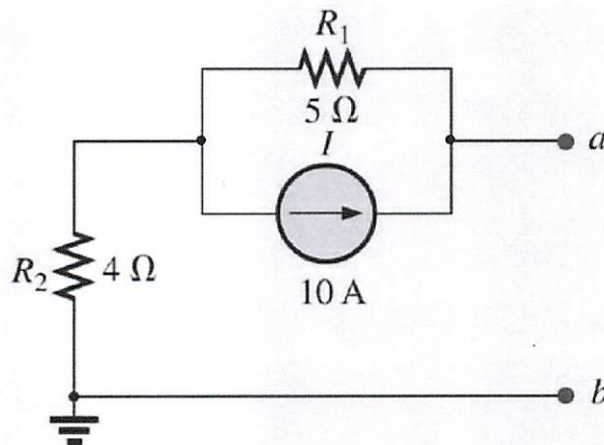
   (C) $R_\Delta = R_Y$

   (D) $R_\Delta = 1/R_Y$

Figure 4.

7. See Figure 4. What is the Thevenin resistance at the terminal a-b?

   (A) 2.22 Ω

   (B) 4 Ω

   (C) 5 Ω

   (D) 9 Ω

8. See Figure 4. What is the Thevenin voltage at the terminals?

   (A) 0 V

   (B) 10 V

   (C) 40 V

   (D) 50 V

9. Thevenin's theorem states that you can replace a bilateral dc network with an equivalent circuit consisting of_____.
   (A) a voltage source and a series resistor.
   (B) a current source and a series resistor.
   (C) a current source and a parallel resistor.
   (D) a voltage source and a parallel resistor.

10. I_N is the _____ current passing through the two-terminal network.
    (A) short circuit   (B) load   (C) fully loaded   (D) open circuit

11. Thevenin's theorem states that the Thevenin voltage is equal to_____.
    (A) open circuit voltage at the network terminals.
    (B) short circuit voltage at the network terminals.
    (C) open circuit current at the network terminals.
    (D) short circuit current at the network terminals.

12. For loads connected directly to a dc-voltage supply, maximum power will be delivered to the load when the _____ is equal to the internal resistance of the source.
    (A) total resistance   (B) Norton resistance
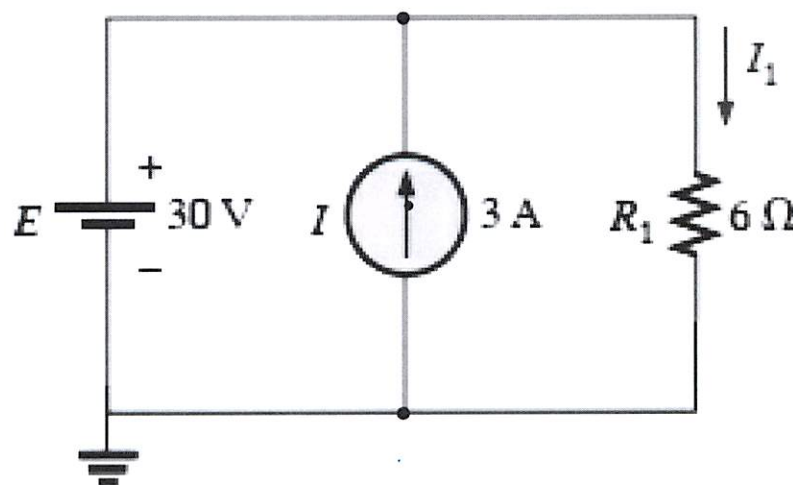   (C) load resistance   (D) Thévenin resistance

Figure 5.

13. See Figure 5. What is the current at R_1?
    (A) 2 A   (B) 3 A   (C) 5 A   (D) 8 A

14. See Figure 5. What is the current from voltage source?
    (A) 2 A   (B) 3 A   (C) 5 A   (D) 8 A

15. A capacitor has a capacitance of 1 farad if 1 _____ of charge is deposited on the plates by a potential difference of 1 volt across the plates.

(A) particle   (B) amp   (C) atom   (D) coulomb

16. What is the total capacitance for two parallel capacitors of 2 Farads and 2 Farads ?

(A) 1 F   (B) 2 F   (C) 4 F   (D) 6 F

17. What is correct for a given capacitor C ?

(A) $Q = CV$ (B) $Q = C/V$ (C) $Q = V/C$ (D) $Q = V^2/C$

18. What is the unit of magnetic flux in SI unit?

(A) Farad   (B) Hertz   (C) Henry   (D) Webber

19. What is the symbol of air core inductor ?

(A)   (B)   (C)   (D)

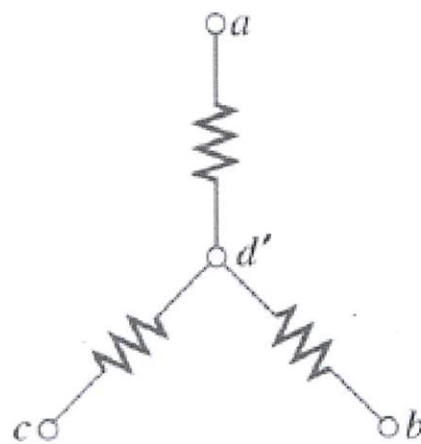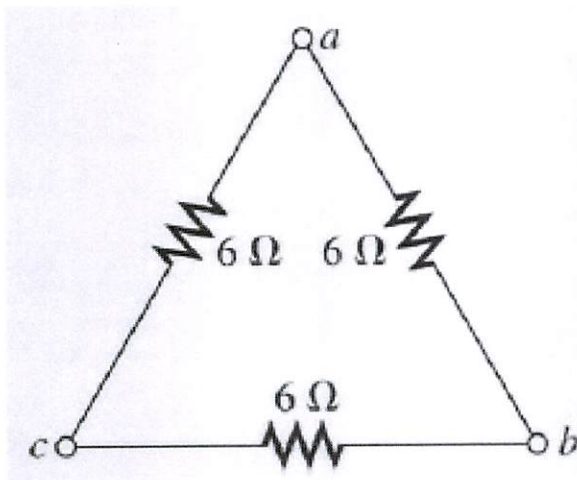20. What are the values of resistors after converting the delta to star ?

Figure 6.

(A) all in 1 Ω   (B) all in 2 Ω   (C) all in 3 Ω   (D) all in 6 Ω
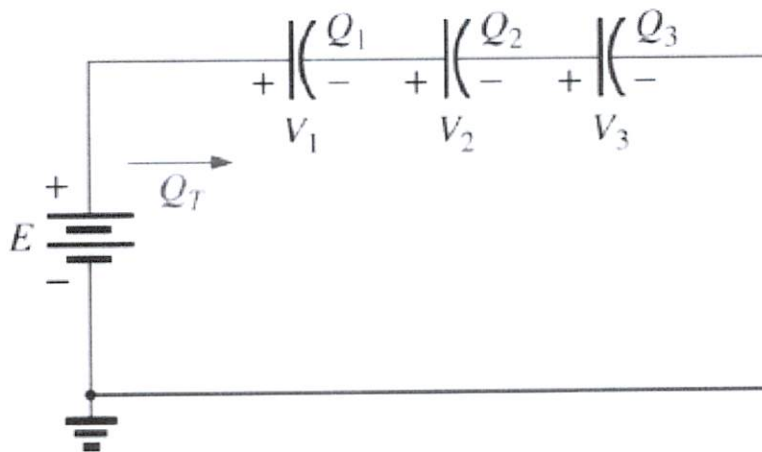
21. What is the correct property from the circuit below ?

Figure 7.

(A) $Q_1 = Q_2 = Q_3$ (B) $V_1 = V_2 = V_3$ (C) $E = Q_1 / V_1$ (D) $E = Q_T C_T$

22. What is the type of capacitor below ?

(A) Polyester   (B) Electrolytic   (C) Tantalum   (D) Surface mount

23. What is the result of x from following two equations ?
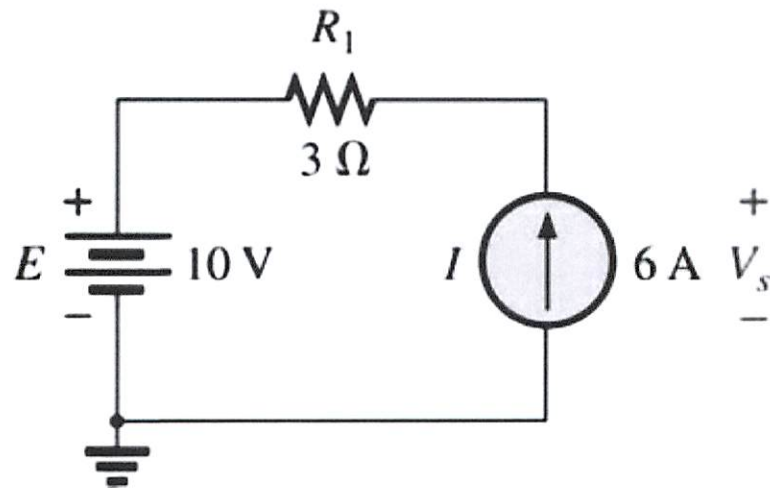
$$-x + 2y = 3$$
$$3x - 2y = -2$$

(A) −2   (B) 0.5   (C) 1   (D) 2

24. What is the value of I_2 ?

$$I_2 = \frac{\begin{vmatrix} 6 & 2 \\ 4 & 6 \end{vmatrix}}{14}$$

(A) 0 A   (B) 0.5 A   (C) 1 A   (D) 2 A

25. Find the value of voltage V_s from the figure below.

R_1

$3\,\Omega$

E — $10\,V$

I — $6\,A$ — V_s

(A) 0 V   (B) 8 V   (C) 18 V   (D) 28 V
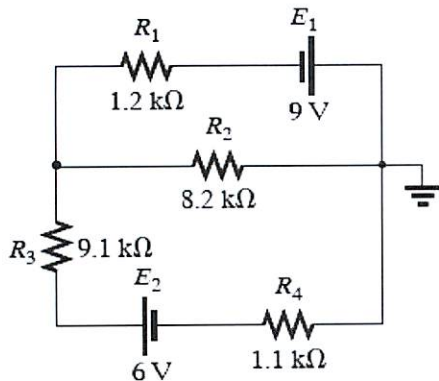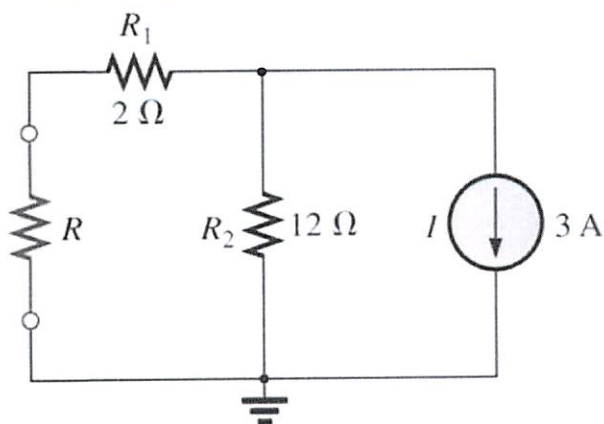
<u>Part 3</u> (20 points) Calculation

Instruction: Show the mathematical expression and answers of following problems.

1. Using the mesh analysis approach, determine the electric current passing <u>each</u> <u>resistor</u> for the given network below.
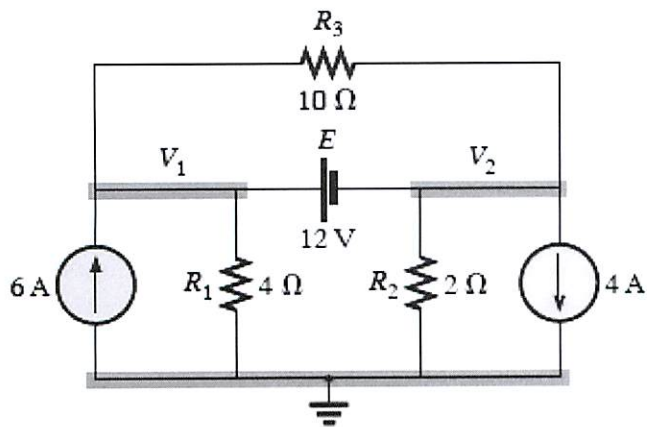

2. Find the Thevenin equivalent circuit for the network below.

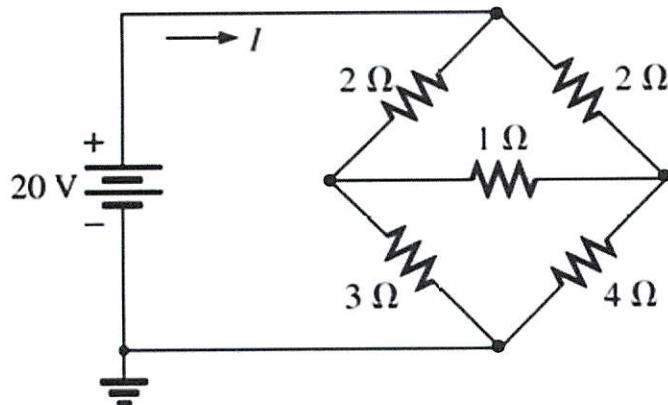3. Use supernode approach to determine the nodal voltages V_1 and V_2 for the network below

4. Determine the electric current I by using star-delta transformation.

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Answer Sheet

Name: _____ ID: _____

Subject: 341151 Electric Circuits I

<u>Part 1</u>

	True	False
1.		
2.		
3.		
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<u>Part 2</u>

	A	B	C	D
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