CITY UNIVERSITY OF HONG KONG

Test 2

Course code & title : EE1002 Principles of Electrical Engineering

Session : Semester A 2021/22

Time allowed : Two hours (one hundred and twenty minutes)

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1. Multiple Choice questions (18 MC questions carry 54 marks)
   Written questions (3 questions carry a total of 54 marks)

2. Start a new page for each written question.

3. It is an open-book examination

Materials, aids & instruments permitted to be used during the examination:

University-approved portable battery-operated calculator

Academic Honesty

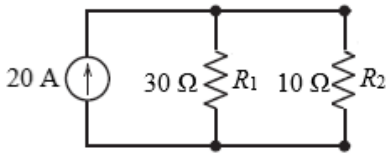
"I pledge that the answers in this exam are my own and that I will not seek or obtain an unfair advantage in producing these answers. Specifically,

- I will not plagiarize (copy without citation) from any source;
- I will not communicate or attempt to communicate with any other person during the exam; neither will I give or attempt to give assistance to another student taking the exam; and
- I will use only approved devices (e.g., calculators) and/or approved device models.
- I understand that any act of academic dishonesty can lead to disciplinary action."

Please reaffirm this honesty pledge by writing "I pledge to follow the Rules on Academic Honesty and understand that violations may lead to severe penalties" onto the "Answer Sheet" attached to this test paper.

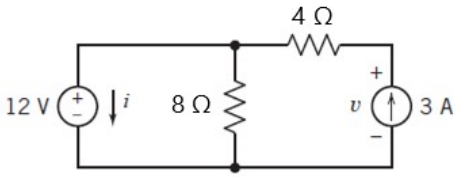
Part I: Multiple choice (Total 60 minutes; 18 questions, 3 points per question)
Please provide your answers in the attached "Answer Sheet".

1. Find the power consumed by resistors R_1 and R_2.



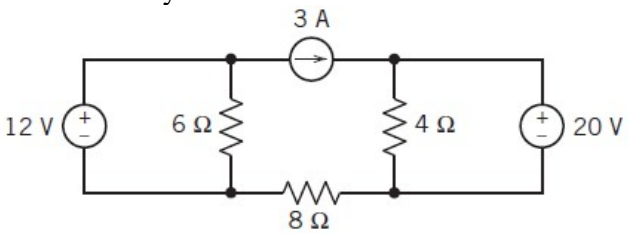
A. $P_1 = 6750\ \text{W}, P_2 = 2250\ \text{W}$
B. $P_1 = 6750\ \text{W}, P_2 = 250\ \text{W}$
C. $P_1 = 750\ \text{W}, P_2 = 2250\ \text{W}$
D. $P_1 = 750\ \text{W}, P_2 = 250\ \text{W}$

2. Find the current i and voltage v.



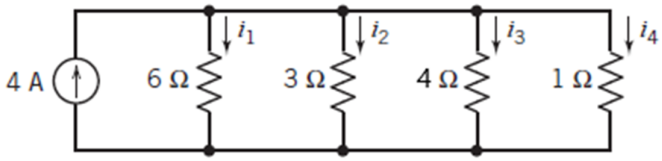
A. $i = -1.5\ A, v = 36\ \text{V}$
B. $i = 1.5\ A, v = 24\ \text{V}$
C. $i = 3\ A, v = 36\ \text{V}$
D. $i = -3\ A, v = 24\ \text{V}$

3. Determine the power absorbed by the 8 Ω resistor.



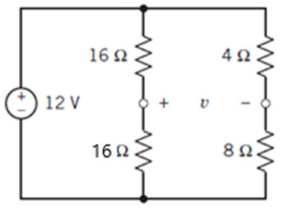
A. $P = 72\ W$
B. $P = 100\ W$
C. $P = 24\ W$
D. $P = 392\ W$

4. Rank the currents from the largest to smallest.



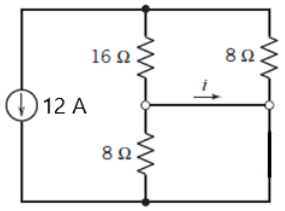
A. $i_1 > i_2 > i_3 > i_4$
B. $i_1 > i_3 > i_2 > i_4$
C. $i_2 > i_1 > i_3 > i_4$
D. $i_4 > i_2 > i_3 > i_1$

5. Find the voltage v.
[Hint: $v = v_{16\Omega} - v_{8\Omega}$, where $v_{16\Omega}$ is the voltage across the lower 16-Ω resistor.]



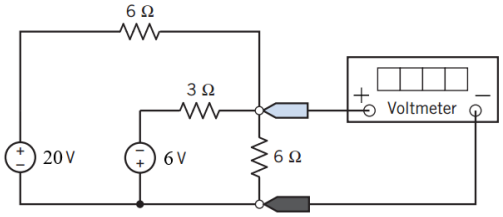
A. $v = 2\ \text{V}$
B. $v = 6\ \text{V}$
C. $v = -6\ \text{V}$
D. $v = -2\ \text{V}$

6. Find the current i.



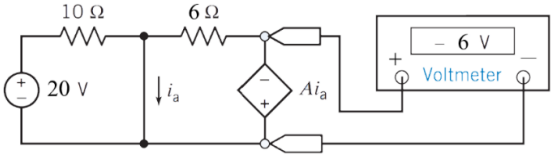
A. $i = 4\ \text{A}$
B. $i = -4\ \text{A}$
C. $i = 8\ \text{A}$
D. $i = -8\ \text{A}$

7. Determine the measured voltage of the ideal voltmeter.



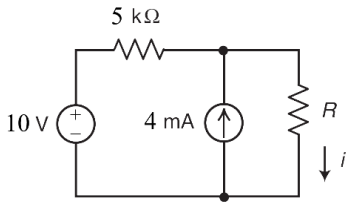
A. $v_m = -2\ V$
B. $v_m = 2\ V$
C. $v_m = -8\ V$
D. $v_m = 8\ V$

8. In the following circuit, find the value of A of the current controlled voltage source.



A. $A = 6.$
B. $A = -6.$
C. $A = 12.$
D. $A = -12.$

9. In the following circuit, determine the relationship between the resistance R and resistor current i.



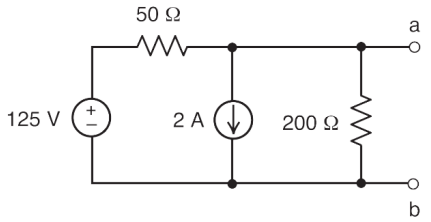
A. $i = \frac{10}{5000+R}$.

B. $i = \frac{-10}{5000+R}$.

C. $i = \frac{30}{5000+R}$.

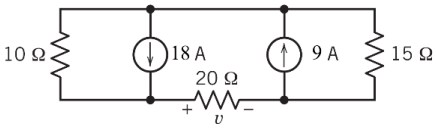
D. $i = \frac{-30}{5000+R}$.

10. Determine the Norton equivalent circuit of the following circuit.



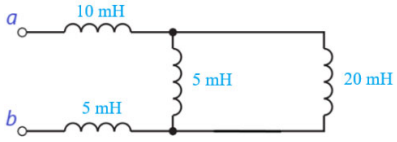
A. $R_N = 40\ \Omega, I_N = 0.5\ \text{A}$
B. $R_N = 40\ \Omega, I_N = 4.5\ \text{A}$
C. $R_N = 250\ \Omega, I_N = 0.5\ \text{A}$
D. $R_N = 250\ \Omega, I_N = 4.5\ \text{A}$

11. Find the voltage v of the following circuit.



A. $v = -20\ V$
B. $v = 20\ V$
C. $v = -140\ V$
D. $v = 140\ V$

12. Find the equivalent inductance L_{ab} across the terminals *a-b* of the following cirucit.



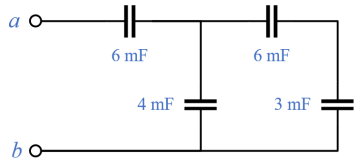
A. 19 mH

B. $\frac{12}{7}$ mH

C. $\frac{5}{2}$ mH

D. 30 mH

13. Find the equivalent capacitance C_{ab} across the terminals *a*-*b* of the following circuit.



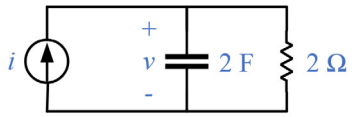
A. 19 mF

B. 3 mF

C. $\frac{114}{13}$ mF

D. $\frac{36}{13}$ mF

14. Find i in the following circuit if $v = 5(1 - 2e^{-2t})$ V.
[Hint: You may use the KCL to solve the problem.]



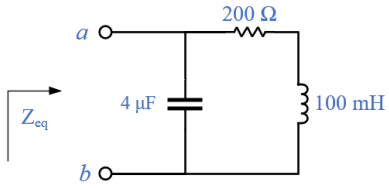
A. $2.5 + 5e^{-2t}$ A

B. $2.5 + 35e^{-2t}$ A

C. $2.5 - 45e^{-2t}$ A

D. $5 - 10e^{-2t}$ A

15. Determine the equivalent impedance Z_{eq} of the following circuit at an angular frequency of $\omega = 1000$ rad/s.



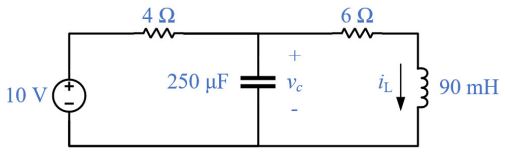
A. $0.25\angle -89.9°\ \Omega$

B. $223.6\angle -26.6°\ \Omega$

C. $0.004\angle 90°\ \Omega$

D. $0.0018\angle 26.6°\ \Omega$

16. Under the steady-state dc condition, find i_L and v_c of the following circuit.

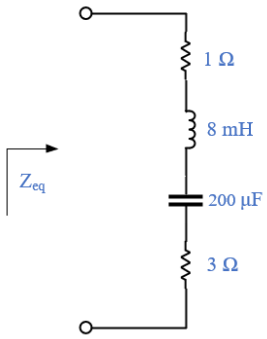


A. $i_L = 1\ \text{A}, v_c = 6\ \text{V}$
B. $i_L = 4\ \text{A}, v_c = 6\ \text{V}$
C. $i_L = 0.125\ \text{A}, v_c = 4\ \text{V}$
D. $i_L = 0.125\ \text{A}, v_c = 3.7\ \text{V}$

17. Determine the capacitance of a capacitor when the voltage across it is $v(t) = 12\cos(500t - 45°)$ **V** with a current of $i(t) = 6\cos(500t + 45°)$ **mA**.

A. $C = 1\ \text{uF}$
B. $C = 1\ \text{mF}$
C. $C = 1.8\ \text{mF}$
D. $C = 0.8\ \text{F}$

18. When $\omega = 1000$ rad/s, find the impedance Z_{eq} seen across the terminals of the following circuit.



A. $5\angle 36.8°\ \Omega$
B. $4\angle 45°\ \Omega$
C. $2\angle -30°\ \Omega$
D. $3.5\ \Omega$

Part II: Written Questions (Total 60 minutes; 3 questions)

Question 1 **(15 points)**

The circuit in Fig. Q1(a) is divided into two parts. The right-hand side is replaced with an equivalent resistor R as shown in Fig. Q1(b).

(a) Determine the value of R. **(3 points)**

(b) If R in Fig. Q1(b) is removed, find the Thevenin equivalent circuit across the terminals m-n. **(4 points)**

(c) Find the current i and voltage v in Fig. Q1(b). **(4 points)**

(d) Find the current i_2 in Fig. Q1(a). **(4 points)**

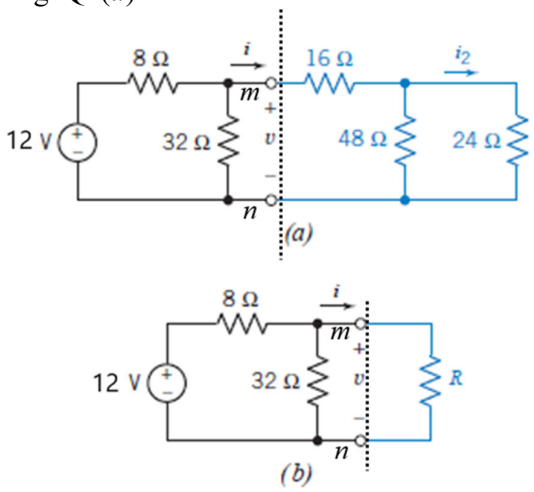


Fig. Q1

Question 2 **(18 points)**

The voltages v_2, v_3, and v_4 of the circuit in Fig. Q2 are given by $v_2 = 24$ V, $v_3 = 6$ V, and $v_4 = 3$ V. Determine

(a) the value of A of the voltage controlled voltage source. **(3 points)**
[Hint: Apply KVL to a loop in which Av_a is the only unknown voltage.]

(b) the resistance R_4. **(3 points)**
[Hint: Determine v_a first from the given values of v_3 and v_4.]

(c) The power absorbed by the resistor R_a. **(3 points)**

(d) The currents i_c and i_b. **(6 points)**

(e) The voltage v_1 of the voltage source. **(3 points)**

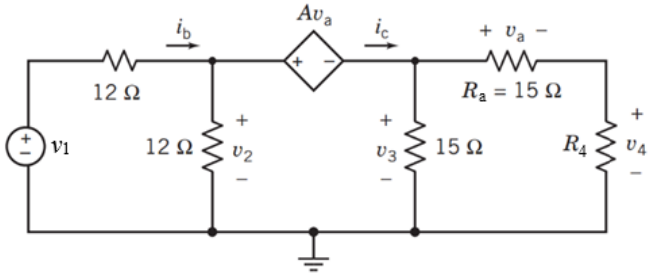


Fig. Q2

Question 3 **(21 points)**

(A) Fig. Q3(a) shows a dc circuit. Find the three mesh currents i_1, i_2, and i_3. **(9 points)**

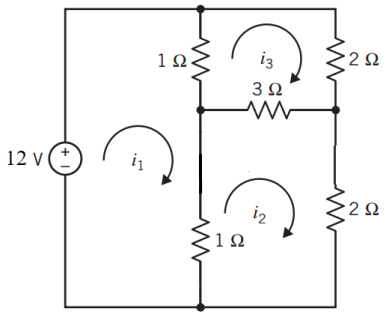


Fig. Q3(a)

(B) A dc current source of 6A is added to the circuit as shown in Fig. Q3(b). Find the three mesh currents i_1, i_2, and i_3. **(12 points)**

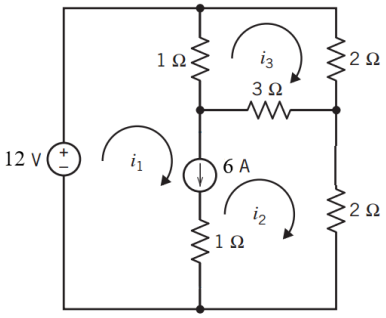


Fig. Q3(b)

Answer Sheet

Honesty Pledge:

Signature: Name: Student No.:

Part I: Answers of multiple-choice questions

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18