# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## SEMESTER II
## SESSION 2011/2012

| | | |
|---|---|---|
| COURSE NAME | : | CIRCUIT THEORY |
| COURSE CODE | : | DAE 11103 |
| PROGRAMME | : | 1 DAE |
| EXAMINATION DATE | : | MARCH 2012 |
| DURATION | : | 3 HOURS |
| INSTRUCTIONS | : | PART A<br>ANSWER **ALL** QUESTIONS<br><br>PART B<br>ANSWER **THREE (3)**<br>QUESTIONS ONLY |

THIS QUESTION PAPER CONSISTS OF FOURTEEN (14) PAGES

**PART A : 40 Marks (MULTIPLE CHOICE QUESTIONS)**

**Q1** The prefix *micro* stands for :

(a) $10^{6}$
(b) $10^{3}$
(c) $10^{-3}$
(d) $10^{-6}$

**Q2** A charge of 2 Coulomb flowing past a given point each second is a current of 2 A.

(a) True
(b) False

**Q3** The current ***I*** in the circuit of Figure Q3 is :

(a) -0.8 A
(b) -0.2 A
(c) 0.2 A
(d) 0.8 A

**Q4** Which of the circuits in Figure Q4 will give you $V_{ab} = 7$ V?

**Q5** At node 1 in the circuit of Figure Q5, applying KCL gives:

(a) $2+\frac{12-v_1}{3}=\frac{v_1}{6}+\frac{v_1-v_2}{4}$

(b) $2+\frac{v_1-12}{3}=\frac{v_1}{6}+\frac{v_2-v_1}{4}$

(c) $2+\frac{12-v_1}{3}=\frac{0-v_1}{6}+\frac{v_1-v_2}{4}$

(d) $2+\frac{v_1-12}{3}=\frac{0-v_1}{6}+\frac{v_2-v_1}{4}$

**Q6** In the circuit of Figure Q6, the voltage $v_2$ is:

(a) -8 V
(b) -1.6 V
(c) 1.6 V
(d) 8 V

**Q7** The loop equation for the circuit in Figure Q7 is:

(a) $-10+4i+6+2i=0$
(b) $10+4i+6+2i=0$
(c) $10+4i-6+2i=0$
(d) $-10+4i-6+2i=0$

**Q8** Refer to Figure Q8. The Thevenin resistance at terminals *a* and *b* is:

(a) 25 Ω
(b) 20 Ω
(c) 5 Ω
(d) 4 Ω

**Q9** Which pair of circuits in Figure Q9 are equivalent?

(a) a and b
(b) b and d
(c) a and c
(d) c and d

**Q10** A load is connected to a network. At the terminals to which the load is connected, $R_{Th} = 10\ \Omega$ and $V_{Th} = 40$ V. The maximum possible power supplied to the load is:

(a) 160 W
(b) 80 W
(c) 40 W
(d) 1 W

**Q11** What charge is on a 5 μF capacitor when it is connected across a 120 V source?

(a) 600 μC
(b) 300 μC
(c) 24 MC
(d) 36 mC

**Q12** The total capacitance of two 40 mF series-connected capacitors in parallel with a 4 mF capacitor is:

(a) 3.8 mF
(b) 5 mF
(c) 24 mF
(d) 44 mF

**Q13** If the current through a 10 mH inductor increases from zero to 2 A, how much energy is stored in the inductor?

(a) 40 mJ
(b) 20 mJ
(c) 10 mJ
(d) 5 mJ

**Q14** An RC circuit has $R = 2\ \Omega$ and $C = 4$ F. The time constant is:

(a) 0.5 s
(b) 2 s
(c) 4 s
(d) 8 s
(e) 15 s

**Q15** In the circuit of Figure Q15, the capacitor voltage just before $t = 0$ is:

(a) 10 V
(b) 7 V
(c) 6 V
(d) 4 V
(e) 0 V

**Q16** If $v_1 = 30\sin(\omega t + 10°)$ and $v_2 = 20\sin(\omega t + 50°)$, which of these statements are true?

(a) $v_1$ leads $v_2$
(b) $v_2$ leads $v_1$
(c) $v_2$ lags $v_1$
(d) $v_1$ lags $v_2$
(e) $v_1$ and $v_2$ are in phase

**Q17** A series *RLC* circuit has $R = 30\ \Omega$, $X_C = 50\ \Omega$, and $X_L = 90\ \Omega$. The impedance of the circuit is:

(a) $30 + j140\Omega$
(b) $30 + j40\Omega$
(c) $30 - j40\Omega$
(d) $-30 - j40\Omega$
(e) $-30 + j40\Omega$

**Q18** The voltage $\mathbf{V}_o$ across the capacitor in Figure Q18 is:

(a) $5\angle 0°\ V$
(b) $7.071\angle 45°\ V$
(c) $7.071\angle -45°\ V$
(d) $5\angle -45°\ V$

**Q19** A quantity that contains all the power information in a given load is the

(a) power factor
(b) apparent power
(c) average power
(d) reactive power
(e) complex power

**Q20** In the power triangle shown in Figure Q20, the reactive power is:

(a) 1000 VAR leading
(b) 1000 VAR lagging
(c) 866 VAR leading
(d) 866 VAR lagging

**PART B : 60 Marks**

**Q21** (a) (i) Find the value of $R_L$ for maximum power transfer in the circuit of Figure Q21(a).

(ii) Find the maximum power.

(12 marks)

(b) Use superposition principal to find $v$ in Figure Q21(b).

(8 marks)

**Q22** (a) Find the equivalent capacitance between terminals $x$ and $y$ for Figure Q22(a).

(5 marks)

(b) The circuit shown in Figure Q22(b) is at steady state condition, determine :

(i) The voltage, $v$ and current, $i$

(ii) The energy stored in the capacitor.

(10 marks)

(c) The voltage across a 200 mH inductor is given by

$$v(t) = 3t^2 + 2t + 4 \quad V \qquad \text{for } t > 0$$

Determine the current $i(t)$ through the inductor. Assume that $i(0) = 1A$.

(5 marks)

**Q23** (a) Switch $S_1$ in Figure Q23(a) has been closed for a long time. At $t = 0$ s, $S_1$ is opened at the same instant that $S_2$ is closed to avoid an interruption in current through the coil.

(i) Find the initial current through the coil, $i_{L(0)}$.

(ii) Find the mathematical expression for the current $i_L$ following the closing of switch $S_2$.

(10 marks)

(b) If the switch in Figure Q23(b) opens at $t = 0$ s,

(i) Find the capacitor voltage $\upsilon(t)$ for $t \geq 0$.
(ii) Calculate the initial energy stored in the capacitor $w_c(0)$.

(10 marks)

**Q24** (a) Two elements are connected in series as shown in Figure Q24(a). If $i(t) = 12\cos(2t - 30°)$ A. Find the element values.

(6 marks)

(b) Calculate *i(t)* in the circuit of Figure Q24(b).

(8 marks)

(c) (i) Express $v = 8 \cos (7t + 15°)$ in sine form.
(ii) Convert $i = -10 \sin (3t - 85°)$ to cosine form.

(3 marks)

(d) Given $v_1 = 20 \sin (\omega t + 60°)$ and $v_2 = 60 \cos (\omega t - 10°)$, determine the phase angle between the two sinusoids and which one lags the other.

(3 marks)

**Q25** Referring to the entire circuit in Figure Q25, calculate :

(a) total load impedance, $Z_T$ (6 marks)

(b) power factor (state whether it is leading or lagging) (2 marks)

(c) complex power (3 marks)

(d) apparent power (3 marks)

(e) average power (real power) delivered by the source (3 marks)

(f) reactive power (3 marks)

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COURSE : CIRCUIT THEORY COURSE CODE : DAE 11103

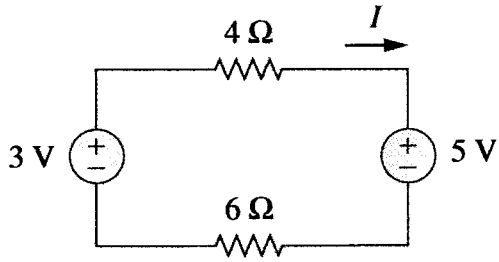


**FIGURE Q3**

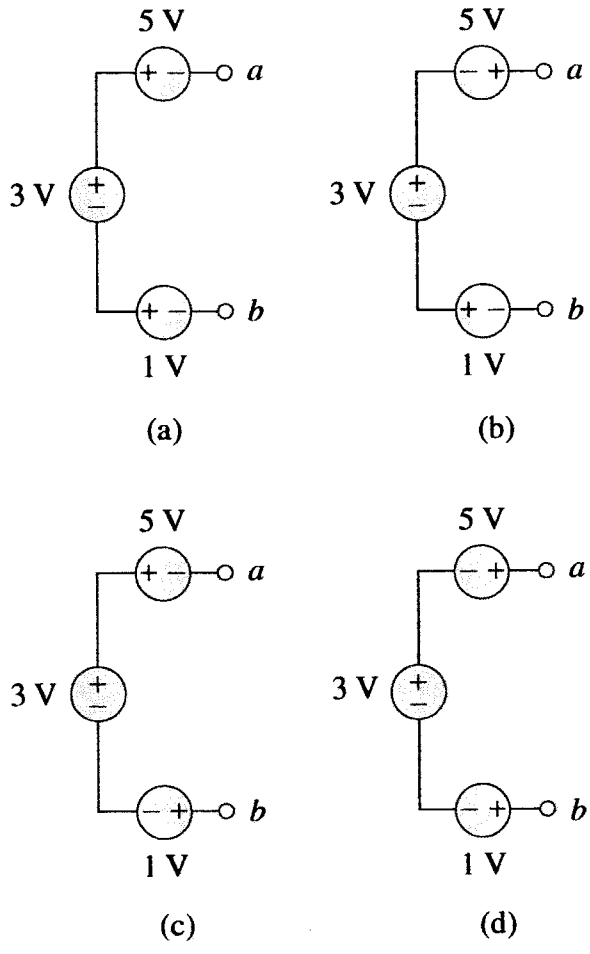


**FIGURE Q4**

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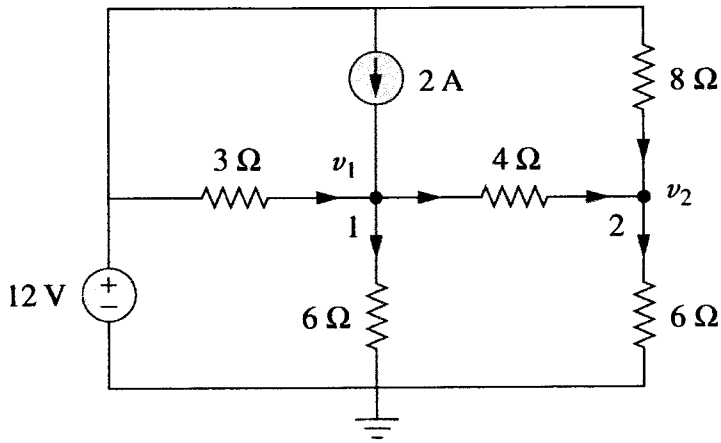


**FIGURE Q5**

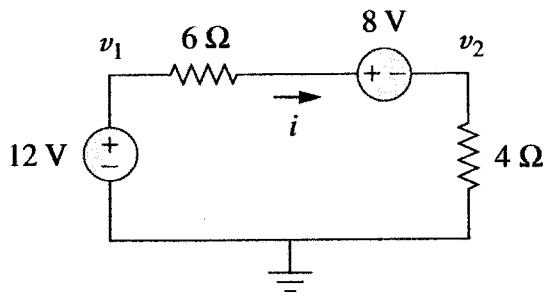


**FIGURE Q6**

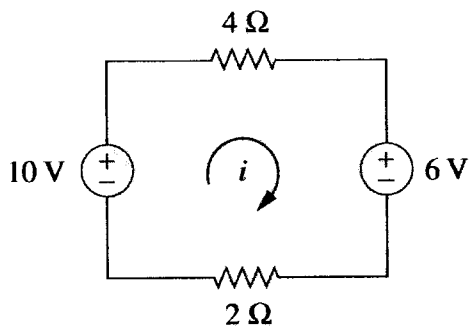


**FIGURE Q7**

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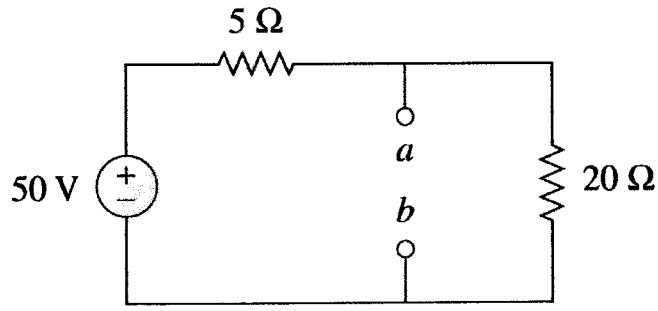


**FIGURE Q8**

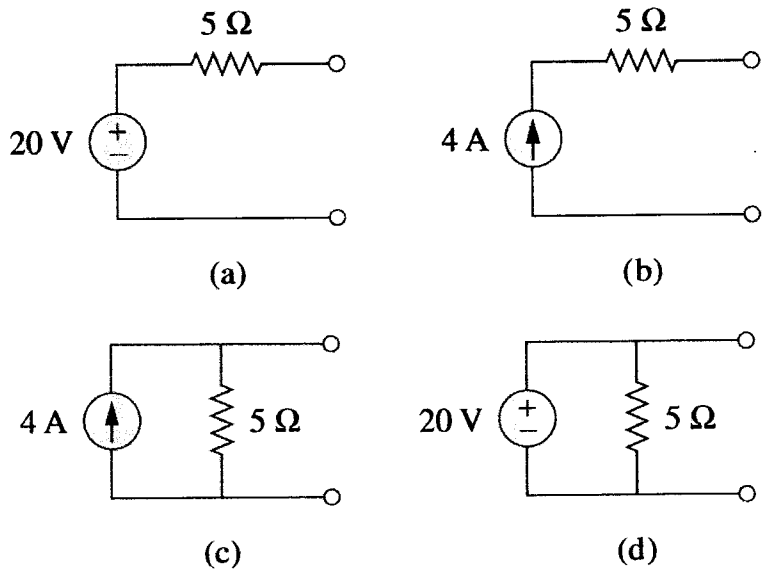


**FIGURE Q9**

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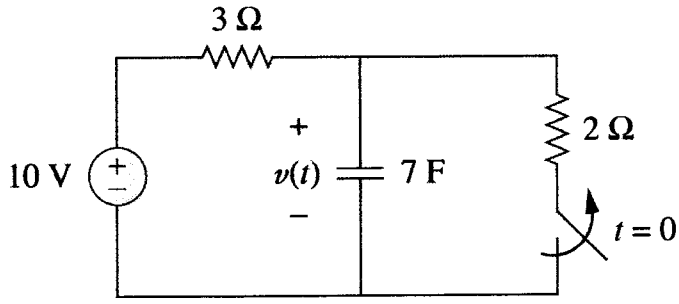


**FIGURE Q15**

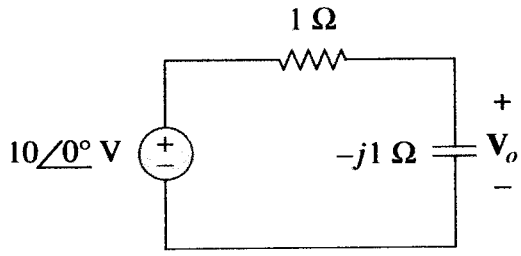


**FIGURE Q18**

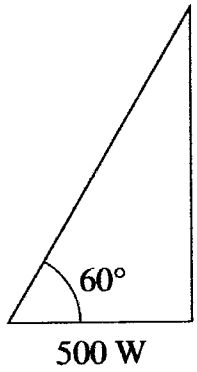


**FIGURE Q20**

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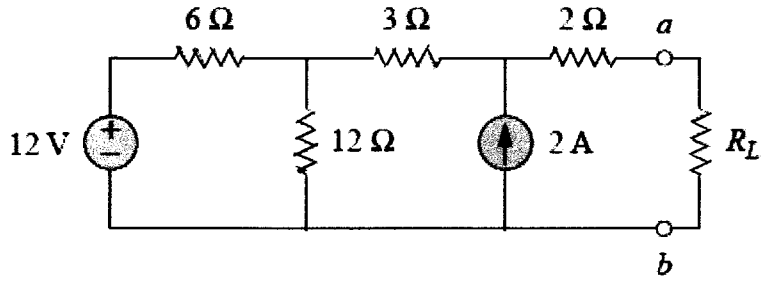


**FIGURE Q21(a)**

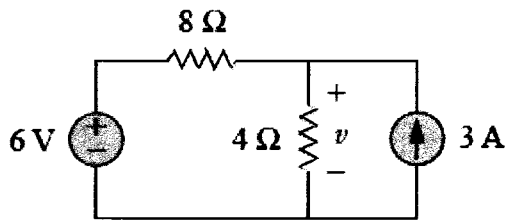


**FIGURE Q21(b)**

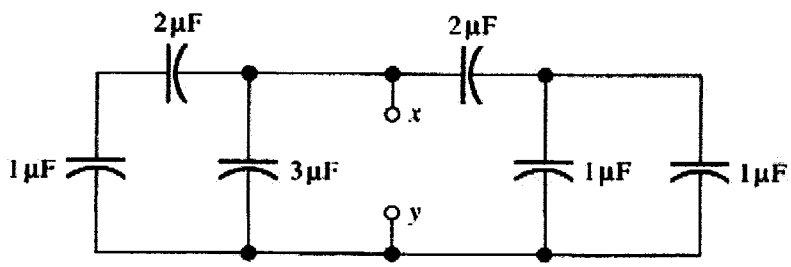


**FIGURE Q22(a)**

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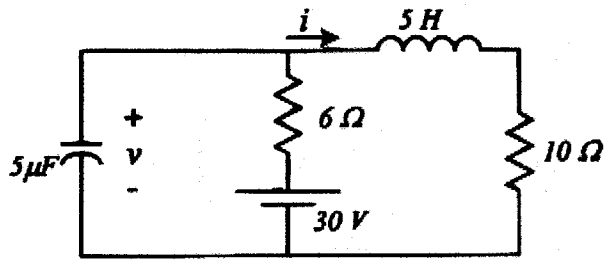


**FIGURE Q22(b)**

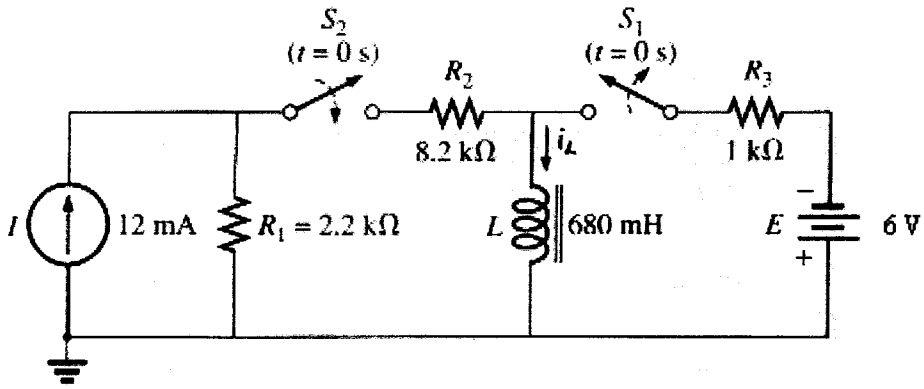


**FIGURE Q23(a)**

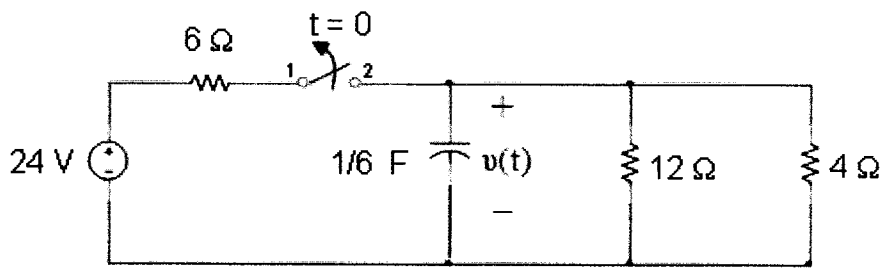


**FIGURE Q23(b)**

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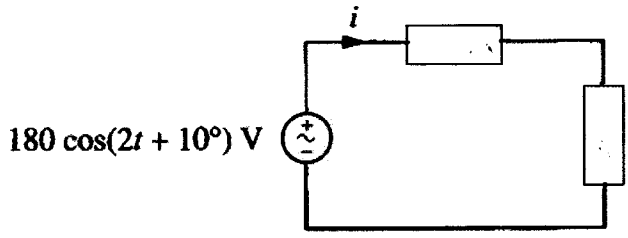


**FIGURE Q24(a)**

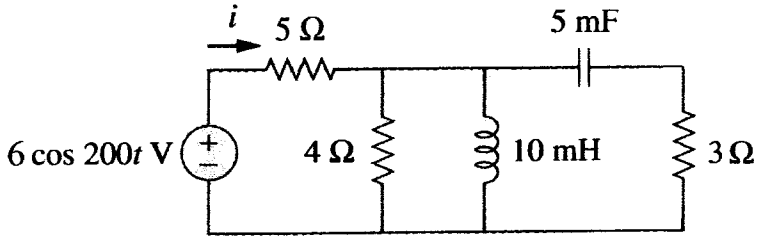


**FIGURE Q24(b)**

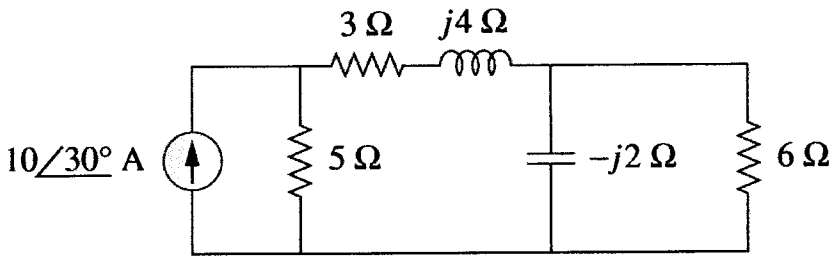


**FIGURE Q25**