66/100



EE210 - Electric Circuits I
Exam I, Form: B

Name: ______

Student Numb ______

Section: ______

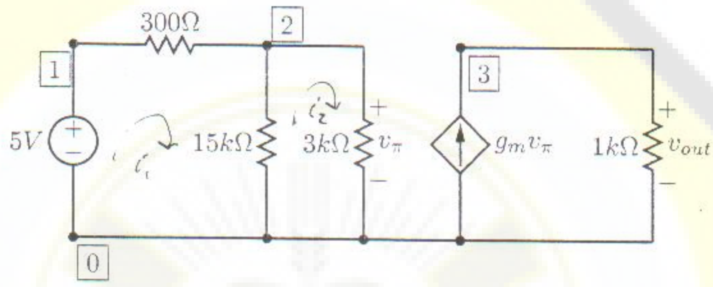
Date: 2007/10/30

The exam contains 2 parts: matching phrases, and short answer.

Total number of points in this exam = 100

## Section 1. Short Answers-B-90 points

1. 15 Points In the circuit below, if $g_m = 0.038$, compute $v_{out}$.




Use mesh anylis :-

$-5 + 300 i_1 + 15\times10^3 (i_1 - i_2) = 0 \Rightarrow 315 i_1 - 15 i_2 = 5$

$15\times10^3 (i_2 - i_1) + 3\times10^3 i_2 = 0 \qquad -15 i_1 + 18 i_2 = 0$

$\Rightarrow i_2 = 0.0137 A$

(-3)

$v_\pi = 3\times10^3 \times 0.0137 = 4$
$= 4.46 V$

$v_{out} = \frac{I}{R} = \frac{g_m v_\pi}{1\times10^3} = \frac{0.038 \times 41.1}{1\times10^3} = 1.56\times10^{-3} V$

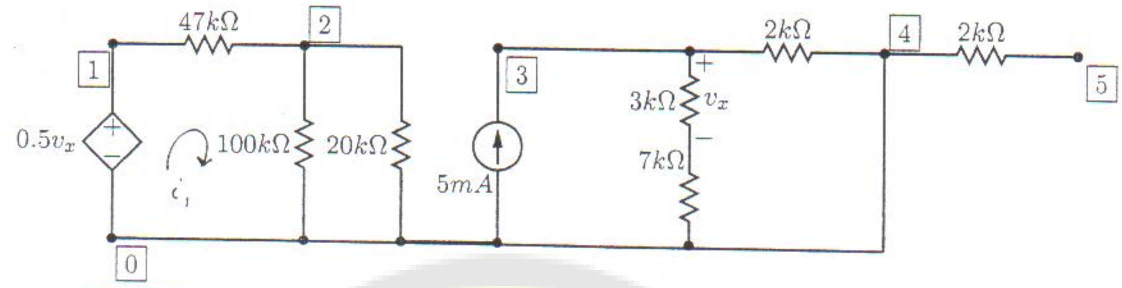
$= IR = g_m v_\pi R = 0.038 \times 41.1 \times 1\times10^3 = 1561.8 V$

$= 169.64 V$

2. 15 Points For the circuit shown below,

(a) what is the power dissipated by the $47\ k\Omega$ resistor ?

(b) what is the voltage at node 5? zero volt




(a) Loop (1) and take $\frac{1}{R_{eq}} = \frac{1}{100} + \frac{1}{20} \Rightarrow R_{eq} = \frac{50}{3}$

$-0.5v_x + 47k\, i_1 + \frac{50}{3} i_1 = 0$

$i_1 = \frac{0.5 v_x}{63.66k\Omega}$

V at node 5: ~~[crossed out]~~

V at node 5 = 0

$\boxed{v_x = IR} = 5\times10^{-3} \times 3\times10^{3} = 15V$

(-4)

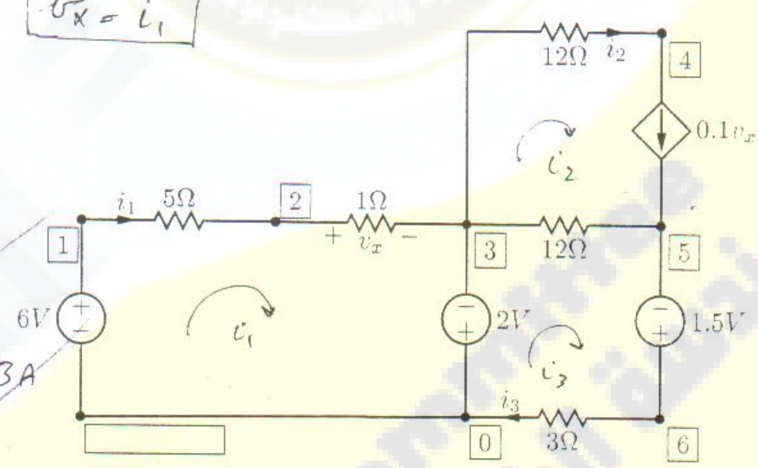
$\therefore i_1 = 0.1178\,A$

$\therefore P_{47\Omega} = i_1^2 R = 652.36\,W$

(absorb +652.36W)

3. 15 Points Determine each mesh current in the circuit shown below $i_1, i_2$, and $i_3$.

$\boxed{v_x = i_1}$




mesh (1)

$-6 + 5i_1 + i_1 - 2 = 0$

$6i_1 = 8 \Rightarrow i_1 = 1.33A$

mesh (2)

$i_2 = 0.1v_x \Rightarrow 0.133A$

mesh (3)

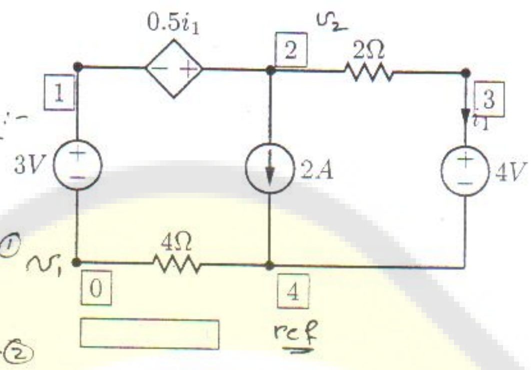
$2 + 12(i_3 - i_2) - 1.5 + 3i_3 = 0$

$2 + 12(i_3 - 0.133) - 1.5 + 3i_3 = 0$

$15 i_3 = -0.5 + 1.596$

$i_3 = 0.073A$

4. 10 Points Find $i_1$ in the circuit shown below. *hint: write KVL for the supermesh*




KVL for the supermesh:-

this is not a KVL

$\frac{v_1}{4} - 2 + \frac{v_2 - 4}{2} + 2 = 0$ —①

$v_1 - v_2 = -3 - 0.5 i_1$ —②

$i_1 = \frac{v_2 - 4}{2}$ ⟹ $i_1 = \frac{3.63 - 4}{2} = -0.185A$

∴ eqe 2 → $v_1 - v_2 = -3 - 0.5\left(\frac{v_2 - 4}{2}\right)$

$v_1 - v_2 + \frac{v_2}{4} = -3 + 1$ —③

$v_1 - \frac{3}{4} v_2 = -2$

$0.25 v_1 + 0.5 v_2 = 2$

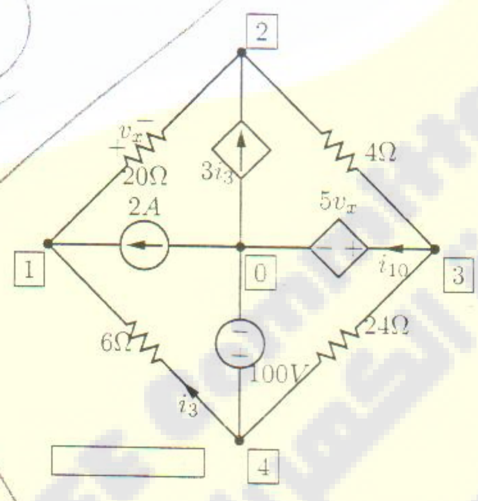
$v_1 = 0.72$

$v_2 = 3.63$

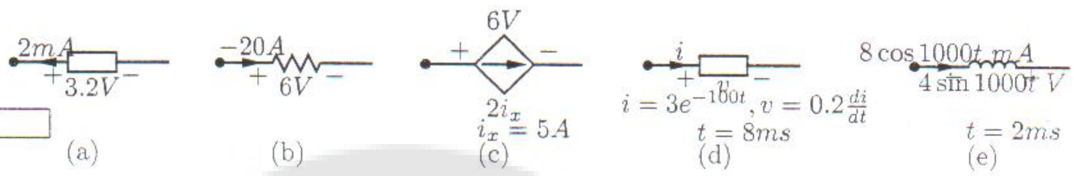
-6

5. 15 Points Determine the two currents labeled $i_3$ and $i_{10}$ in the circuit below.

-15



6. 10 Points Determine the power being absorbed by each of the circuit elements shown in the figure below




(a) $P = iV = (-2\times10^{-3} \times 3.2)$
$= -6.4\times10^{-3}$ W

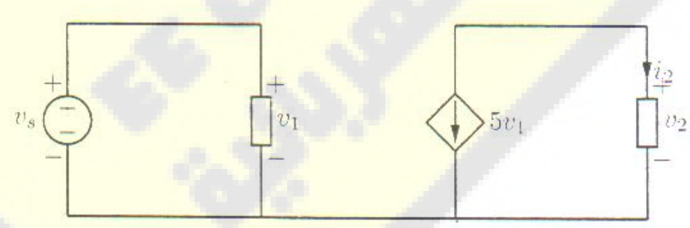
(b) $P = \frac{V^2}{R} = \frac{(6)^2}{}$
$= iV = (-20)6 = -120$ W

(c) $P = iV = 2\times5 \times 6 = 60$ W

(d) $iV = 1.347 \times -26.95 = -36.31$ W

(e) $iV = (8\cos(1000\times2\times10^{-3})\times10^{-3} \times 4\sin(1000\times2\times10^{-3})) =$
$= 1.116\times10^{-3}$ W

7. 10 Points For the circuit shown below, if $v_2 = 1000 i_2$ and $i_2 = 5mA$, determine $v_s$.




$1000 i_2$

$i_2 = 5\times10^{-3}$

$v_s = v_1$

$i_2 = -5v_1$

$v_1 = \frac{i_2}{-5} = -1\times10^{-3}$

$\therefore V_s = -1\times10^{-3}$ V

Section 2. 10 Points-B - 1 point each Match the corresponding phrases

| | | | |
|---|---|---|---|
| d | KCL is a translation of the fact that | (a) | *voltages as the unknowns* |
| f | The unit for measuring energy is | (b) | *common node* |
| i | The unit for measuring power is | (c) | *any circuit* |
| e | Writing mesh equations applies to | (d) | *currents as the unknowns* |
| d | Mesh equations have the | (e) | *planar circuits* |
| a | KVL is a translation of the law that | (f) | *Joule* |
| b | Writing node equations applies to | (g) | *energy is conserved* |
| a | Nodal equations have the | (h) | *number of mesh currents* |
| j | In using nodal analysis we do not write KCL for the | (i) | *Watt* |
| h | Number of Mesh equations equals | (j) | *a point can not hold charge* |

(-6)

EE210 - Electric Circuits I
Exam 2, Form: B

Name: ______________________
Student Number: ______________________
Section: ______________________
Date: ______________________

The exam contains 2 parts: True/False and short answers.

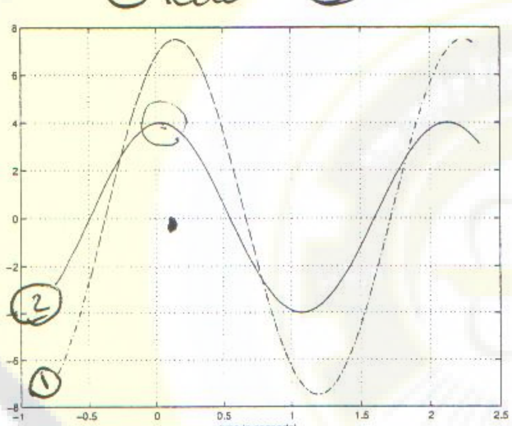
Total number of points in this exam = 100

Section 1. True/False — 20 Points-B - 1 point each

**True** The voltage across the capacitor can not change in zero-time interval.

**False** The two curves represent different sinusoids having the same frequency. The dotted curve represents a voltage that is leading the voltage represented by the solid curve.

② leads ①




**True** To apply superposition principle, the circuit should be linear.

**False** The load resistor absorbs maximum power if its value is one-half the Thevenin equivalent resistor.

**False** The capacitor is open circuit for DC currents.

**True** The ideal capacitor does not dissipate energy but only stores it for finite time period.

**True** The Norton equivalent is a source transformation of the Thevenin equivalent.

**True** The elements having their voltages or currents controlling dependent sources should not be included in source transformation.

**False** The Thevenin equivalent of a linear circuit is a simple resistor connected in series with dependent source.

**False** The current through the capacitor can not change in zero-time interval.

**False** The current passing through the inductor can be changed in zero time.

$v = L\frac{di}{dt}$

**True** The capacitor can store finite amount of energy in its electric field only if the current passing through it is time-varying (not DC).

**False** The Norton equivalent circuit is simply a resistor connected in parallel with an independent voltage source.

$v = L\frac{di}{dt}$

**False** The inductor is open circuit for DC voltage.

**False** Maximum power transfer to a given load can be satisfied for any value of the load resistor.

**True** In a series RL circuit, the resistor voltage is proportional to the derivative of the inductor current.

**False** In a capacitive circuit, the current leads the voltage.

**True** Using superposition principle, the total response of a circuit is just the algebraic sum of the contributions of independent sources on that response.

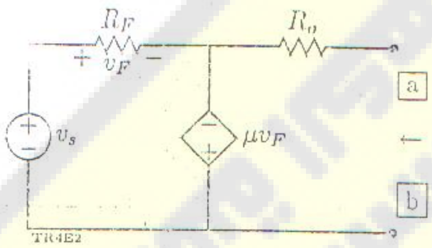
**True** Source transformation can be applied to independent as well as dependent sources.

**True** The Thevenin equivalent of a DC circuit that doest not contain independent sources is a simple resistor.

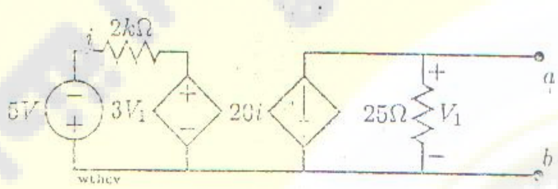
17/20

Section 2. 80 points-B- 10 questions, 8 points each

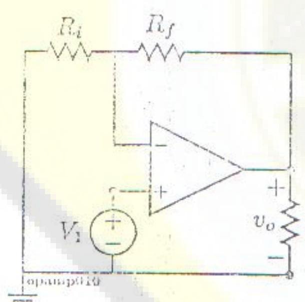
1. For the circuit shown below, Thevenin resistance $R_T$ = as seen between [a] and [b] =



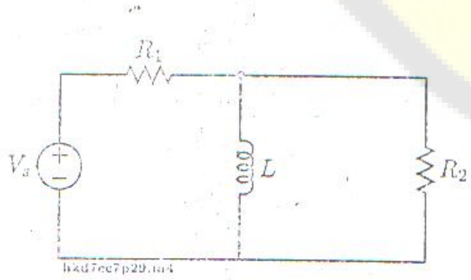

2. For the circuit shown below, find Thevenin equivalent circuit as seen between terminals (a) and (b).




3. What value of $R_i$ is required so that the power delivered to the $R_o$ resistor is $P_l$?
Take $P_l = 150mW, R_f = 10k\Omega, R_o = 10k\Omega, V_1 = 10V$.



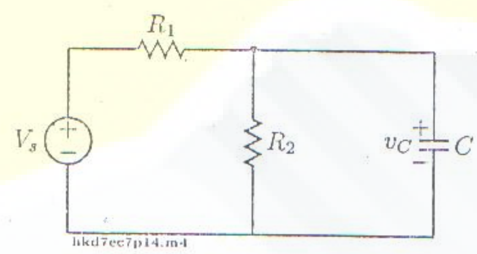

4. For the circuit shown below, compute the power dissipated by the resistors $R_1$ and $R_2$. Take $R_1 = 100\Omega, R_2 = 200\Omega, L = 1H, V_s = 12V$.



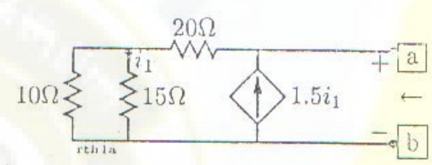

5. The current through the capacitor is given by $i(t)$. If the energy stored at $t = t_0$ is $K$ $J$, what is the value of the capacitance? Take $i(t) = 20\sin(120t)A, t_0 = 0.2sec, K = 3$

6. If the current passing through an inductor $i(t) = 4 + 5t^2$ and the voltage across it $v_L(t) = 30t$ find $L$ in Henry.

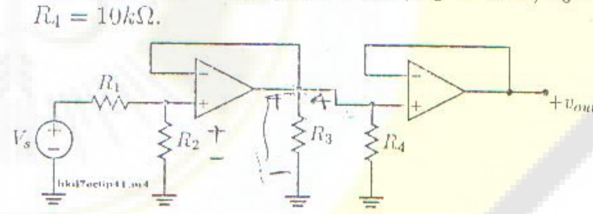
7. For the DC circuit shown below, find the voltage $v_C$. Take $V_s = 12.5V, R_1 = 2.5k\Omega, R_2 = 20k\Omega, C = 7\mu F$.




8. Find Thevenin's equivalent circuit voltage as seen between [a] and [b].




9. Compute $v_{out}$ for the two-stage opamp circuit below. Take $V_s = 10V, R_1 = 1k\Omega, R_2 = 4k\Omega, R_3 = R_4 = 10k\Omega$.




10. (a) Find Thevenin equivalent of the network shown below as seen by the load resistor $R_L$.
Take $R_1 = 10\Omega, R_2 = 20\Omega, R_3 = 30\Omega, R_4 = 40\Omega, R_L = 10\Omega, V_1 = 10$ Volts
(b) Find the power dissipated in the load resistor $R_L$.