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CASE WESTERN RESERVE UNIVERSITY
Case School of Engineering
Department of Electrical Engineering and Computer Science
ENGR 210. Introduction to Circuits and Instruments (4)

Quiz No. 6 **2/25/05**

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE. BE SURE TO STATE ANY ASSUMPTIONS

+8

MAXIMUM SIGNAL TRANSFER

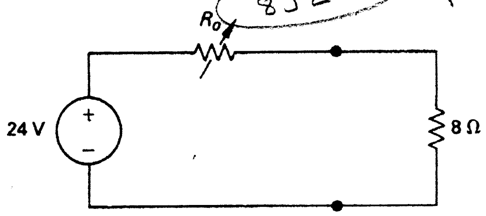
Problem 1 (10 points)

(a) Find the value of the variable resistor Ro in the circuit below that will result in maximum power dissipation in the 8-Ω load resistor.

8Ω

power is maximum when $R_L = R_o$

+6



(b) What is the maximum power that can be delivered to the 8-Ω load resistor.

(c) If R_o increases from 10Ω to 25Ω, the power dissipated by the 8Ω load will (circle one)

(i) increase

+2

(ii) remain the same

[✓ (iii) decrease.]

voltage divider → $V_L = R_L / R_o + R_L$ → gets sm

so power gets small

b) $V_L = \left(8\Omega / 8\Omega + 8\Omega\right)(24V) = 12V$

$P = V^2 / R = 144 / 8 = 18W$

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Name : ________________________ Section:_________ CWRU e-mail:____________

LINEAR DEPENDENT SOURCES

$i_x + 0.9A - 10i_x = 0$

$16 - V_A/2 + 0.9A - 10i_x = 0$

$8.9A - 10i_x$

Problem 2 (10 points)

Consider this active circuit with a dependent source. Assume $R_L = 6\Omega$

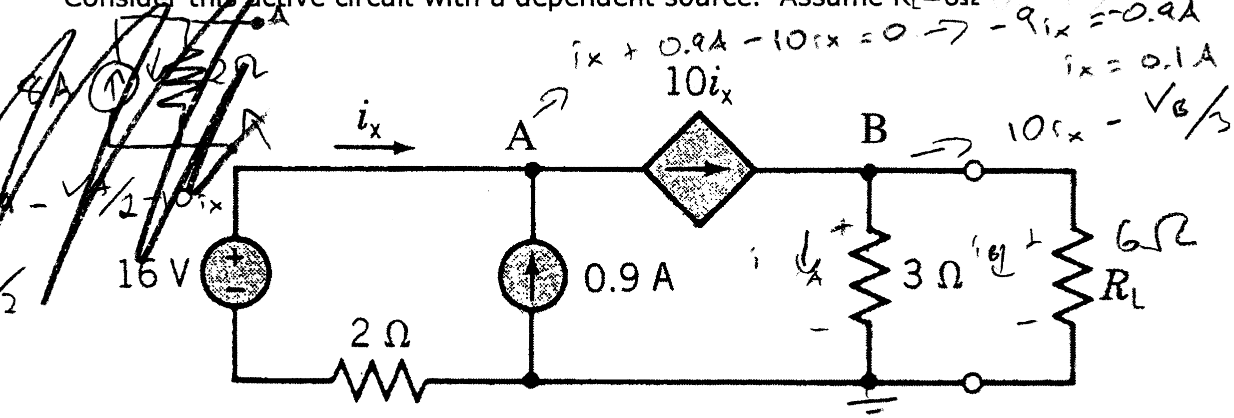
$i_x + 0.9A - 10i_x = 0 \rightarrow -9i_x = -0.9A$

$i_x = 0.1A$

$10i_x - V_B/3 - V_B/6 =$

~~$A - 8.9A - V_A/2 - 10i_x$~~

~~$V_A - 16/2$~~



a) Write node analysis equations (KCL) for nodes A and B in terms of i_x and the given circuit parameters. These are the connection equations. Do not write i_x in terms of other circuit variables for this part of your answer.

+2

+2

Node	Node-Voltage Equation				
A	$1/2$	$\cdot V_A$	+	0	$\cdot V_B$ = $8.9A - 10i_x$
B	0	$\cdot V_A$	+	$1/2$	$\cdot V_B$ = $10i_x$

b) Now write an expression for i_x in terms of V_A, V_B and the given circuit parameters. (This is a constraint equation.)

$i_x + 0.9A - 10i_x = 0$

$9i_x = 0.9A$

$i_x = 0.1A$

$V_B/2 = 10i_x$

$i_x = V_B/20$

$i_x = 16 - V_A/2$

2

c) Using your equations from parts (a) and (b) determine the node voltages for the above circuit values.

nm ok

V_A	~~15.8V~~	V_B	2V

~~16.2~~

+3

$i_x = 0.1A$

$V_A/2 = 8.9A - 1A$

$V_A/2 = 7.9A$

$V_A = 15.8V$

$V_B/2 = 10i_x = 1A$

$V_B = 2V$

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+8

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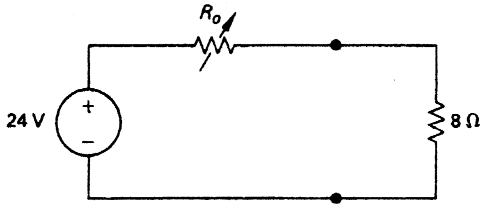
MAXIMUM SIGNAL TRANSFER

Problem 1 (10 points)

(a) Find the value of the variable resistor Ro in the circuit below that will result in maximum power dissipation in the 8-Ω load resistor.

$\boxed{R_o = R_L = 8\Omega}$

+6



(b) What is the maximum power that can be delivered to the 8-Ω load resistor.

(c) If R_o increases from 10Ω to 25Ω, the power dissipated by the 8Ω load will (circle one)

(i) increase

+8 (ii) remain the same

[✓ (iii) decrease.]

(b) $P = \frac{R_T V_T^2}{(R_L + R_T)^2} = \frac{8(24^2)}{16^2} = \boxed{18\,W}$

(c) $\frac{R_L V_T^2}{(R_L + R_T)^2} = \frac{10(24^2)}{(18)^2} = 17.77$

$= \frac{25(24^2)}{(33)^2} = 13$

Name : David Anderson Section: ME CWRU e-mail: dca7

LINEAR DEPENDENT SOURCES

Problem 2 (10 points)

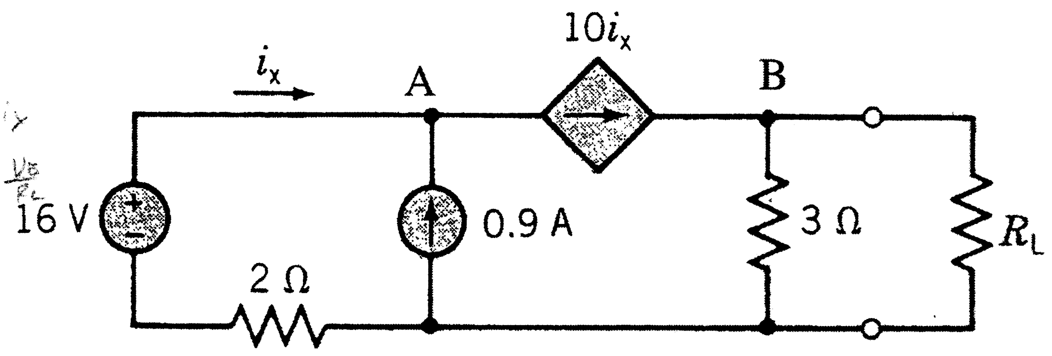
Consider this active circuit with a dependent source. Assume $R_L=6\Omega$

ix + .9 - 10 ix

$10 ix - \frac{VB}{3} - \frac{VB}{R_L}$

$\frac{1}{3} + \frac{1}{R_L}$

$V_A = 16V$



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a) Write node analysis equations (KCL) for nodes A and B in terms of i_x and the given circuit parameters. These are the connection equations. Do not write i_x in terms of other circuit variables for this part of your answer.

Node	**Node-Voltage Equation**		
A	1 $\cdot V_A$	+ 0 $\cdot V_B$	= 16V + 2 ix
B	0 $\cdot V_A$	+ $\frac{1}{3} + \frac{1}{R_L}$ $\cdot V_B$	= 10ix

+1

+2

b) Now write an expression for i_x in terms of V_A, V_B and the given circuit parameters. (This is a constraint equation.)

ix = -.9A + 10ix

1

c) Using your equations from parts (a) and (b) determine the node voltages for the above circuit values.

V_A	16V	V_B	2V

+2

.9 = 9ix

ix = .1A

$V_A = V_S = 16V$

No

$(\frac{1}{3} + \frac{1}{6})V_B = 10 i_x$

$\frac{1}{2} V_B = 10(.1)$

$V_B = 2V$

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Quiz No. 6 **2/25/05**

PUT ANSWERS IN THE SPACE PROVIDED AND SHOW YOUR WORK IF APPROPRIATE. BE SURE TO STATE ANY ASSUMPTIONS

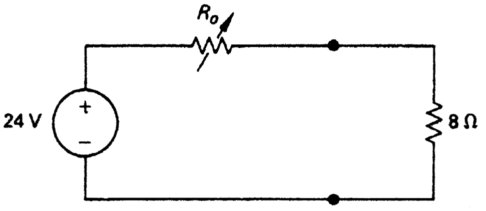
+10

MAXIMUM SIGNAL TRANSFER

Problem 1 (10 points)

(a) Find the value of the variable resistor Ro in the circuit below that will result in maximum power dissipation in the 8-Ω load resistor.

$P = V^2/R = 576/(8+R_o)$



(b) What is the maximum power that can be delivered to the 8-Ω load resistor.

(c) If R_o increases from 10Ω to 25Ω, the power dissipated by the 8Ω load will (circle one)

(i) increase

+2 (ii) remain the same

[✓ (iii) decrease]

a.) since $P = V^2/R$, a resistance of 0 ohm at R_o will lead to the smallest R, and thus the largest P.

+8

b.) $P = 24^2/8 = 72$ W.

c.) iii) decrease.

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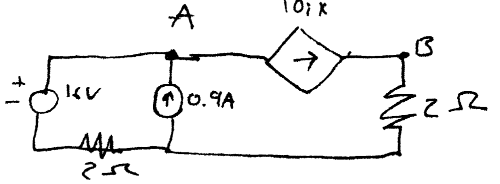


LINEAR DEPENDENT SOURCES

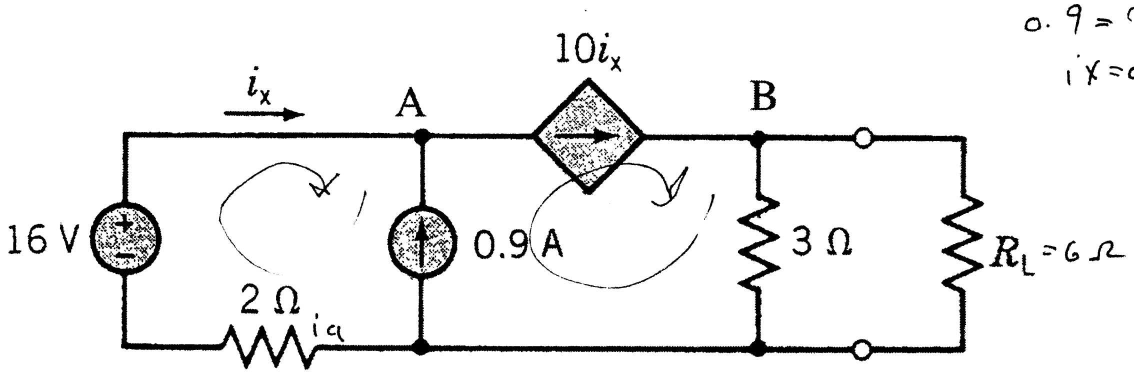
Problem 2 (10 points)

Consider this active circuit with a dependent source. Assume $R_L=6\Omega$ ix +0.9 − 10ix = 0

0.9 = 9ix

ix = 0.1 A

+2



a) Write node analysis equations (KCL) for nodes A and B in terms of i_x and the given circuit parameters. These are the connection equations. Do not write i_x in terms of other circuit variables for this part of your answer.

Node	**Node-Voltage Equation**		
A	16Va	+· 2·10ix vb	= 16V
B	·V_A	+· ·V_B	= 0

4

b) Now write an expression for i_x in terms of V_A, V_B and the given circuit parameters. (This is a constraint equation.)

$$ix = \frac{16 \cdot Va}{20\ Vb} = 0.1A$$

+1

c) Using your equations from parts (a) and (b) determine the node voltages for the above circuit values.

V_A	16V +1	V_B	~~128V~~