EECS170A Spring 2007 **Midterm Exam #2** Name:__________________________

5/28/2007 11:00 to 12:20 pm ID no.:__________________________

Professor Peter Burke

1	2	3	4	5	Total
/20	/20	/20	/20	/20	/100

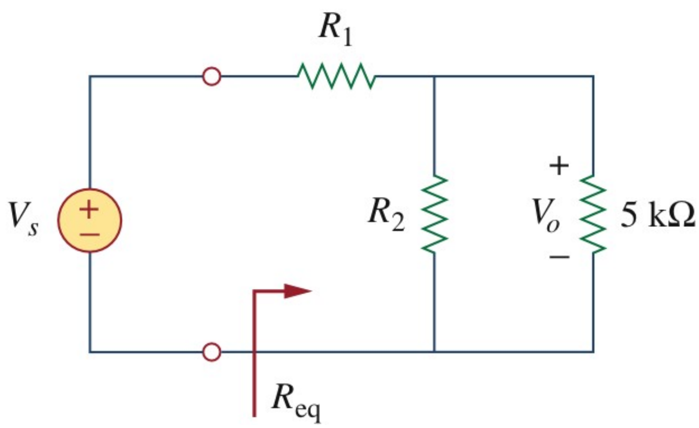
DO NOT BEGIN THE EXAM UNTIL YOU ARE TOLD TO DO SO.

PROBLEM ONE: (20 points)

In a certain application, the circuit in the figure below must be designed to meet these two criteria:

(a) $V_o / V_s = 0.05$ (b) $R_{eq} = 40\ \text{k}\Omega$

If the load resistor 5 kΩ is fixed, find R_1 and R_2 to meet the criteria.

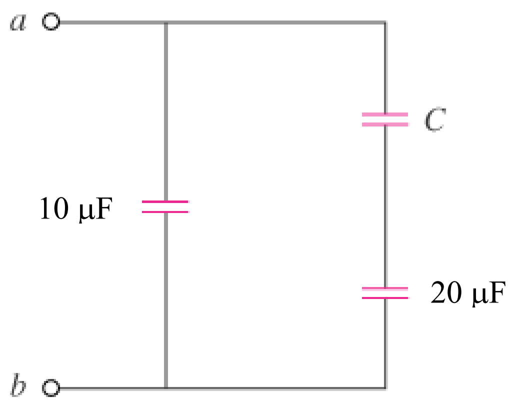


PROBLEM TWO:

A load is connected to a network. At the terminals to which the load is connected, R_{Th} = 10 Ω and V_{Th} = 40 V. Find the maximum possible power supplied to the load.

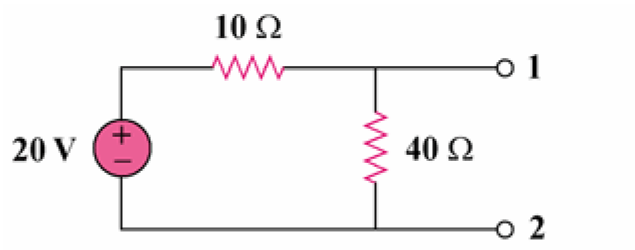
PROBLEM THREE:

The equivalent capacitance at terminals *a*-*b* in the circuit in the figure below is 20 μF. Calculate the value of *C*.



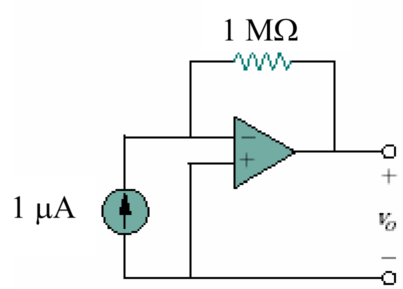
PROBLEM FOUR:

Determine R_{Th} and V_{Th} at terminals 1-2 of the circuits shown below.



PROBLEM FIVE:

Obtain v_o for the op amp circuit shown below.



Spring, 2007

EECS70A / CSE 70A Network Analysis I
Prof. Peter Burke

Midterm II solution

Grading criteria: for all questions, no credits for answers without units and -5pts for each wrong unit.

Problem 1:

Criteria: (a) $V_o / V_s = 0.05$ and (b) $R_{eq} = 40$ kΩ

From the circuit, $R_{eq} = R_1 + R_2 \parallel 5$ kΩ = 40 kΩ

Using voltage divider: $V_o = V_s$. ($R_2 \parallel 5$ kΩ) / ($R_1 + R_2 \parallel 5$ kΩ)

V_o / V_s = ($R_2 \parallel 5$ kΩ) / ($R_1 + R_2 \parallel 5$ kΩ) = 0.05

($R_2 \parallel 5$ kΩ) = 0.05 x 40 kΩ = 2 kΩ

(R_2 x 5 kΩ) / (R_2 + 5 kΩ) = 2 kΩ

$R_2 = 0.4\ R_2$ + 2 kΩ

$\therefore R_2$ = 3.3 kΩ

$\therefore R_1$ = 40 kΩ - $R_2 \parallel 5$ kΩ = 38 kΩ

Grading criteria:
- -5pts for every incorrect equation
- -2pts for each wrong substitution
- -2pts for wrong final answers

Problem 2:

To have maximum possible power supplied to the load, $R_{Th} = R_L = 10\Omega$

Wmax = $V_{Th}^2 / 4R_{Th} = (40)^2 / (4 \times 10) = 40$ W

Grading criteria:
- -5pts for incorrect equation
- -5pts for wrong R_L
- -5pts for wrong substitutions
- -2pts for wrong final answer

Problem 3:

10 F + 1 / (1/C + 1/20 F) = 20 F

1/C + 1/20 F = 1/ 10uF

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Criteria: (a) $V_o / V_s = 0.05$ and (b) $R_{eq} = 40$ kΩ

From the circuit, $R_{eq} = R_1 + R_2 \parallel 5$ kΩ $= 40$ kΩ

Using voltage divider: $V_o = V_s . (R_2 \parallel 5\text{ k}\Omega) / (R_1 + R_2 \parallel 5\text{ k}\Omega)$

$V_o / V_s = (R_2 \parallel 5\text{ k}\Omega) / (R_1 + R_2 \parallel 5\text{ k}\Omega) = 0.05$

$(R_2 \parallel 5\text{ k}\Omega) = 0.05 \text{ x } 40\text{ k}\Omega = 2\text{ k}\Omega$

$(R_2 \text{ x } 5\text{ k}\Omega) / (R_2 + 5\text{ k}\Omega) = 2\text{ k}\Omega$

$R_2 = 0.4\, R_2 + 2\text{ k}\Omega$

$\therefore R_2 = 3.3\text{ k}\Omega$

$\therefore R_1 = 40\text{ k}\Omega - R_2 \parallel 5\text{ k}\Omega = 38\text{ k}\Omega$

Grading criteria: -5pts for every incorrect equation
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