ID:	Name:

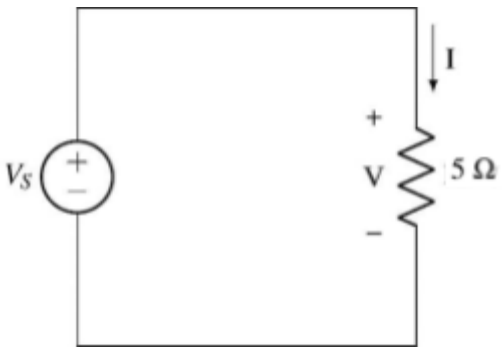
Set: 2

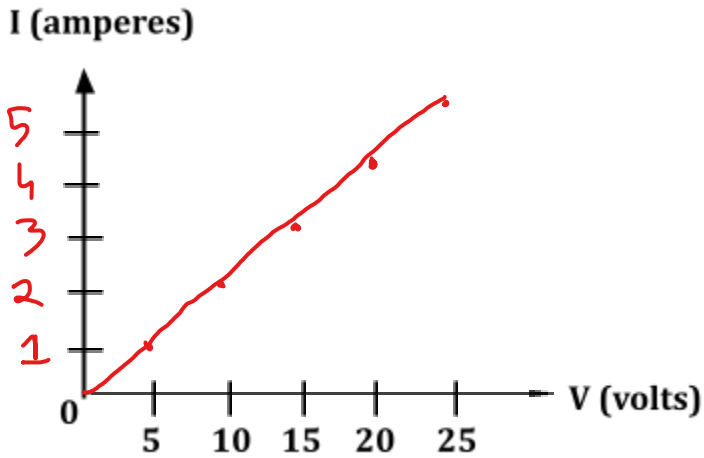
Brac University

Semester: Summer 2022
Course No: CSE250
Course Title: CIRCUITS AND ELECTRONICS
Date: September 09, 2022

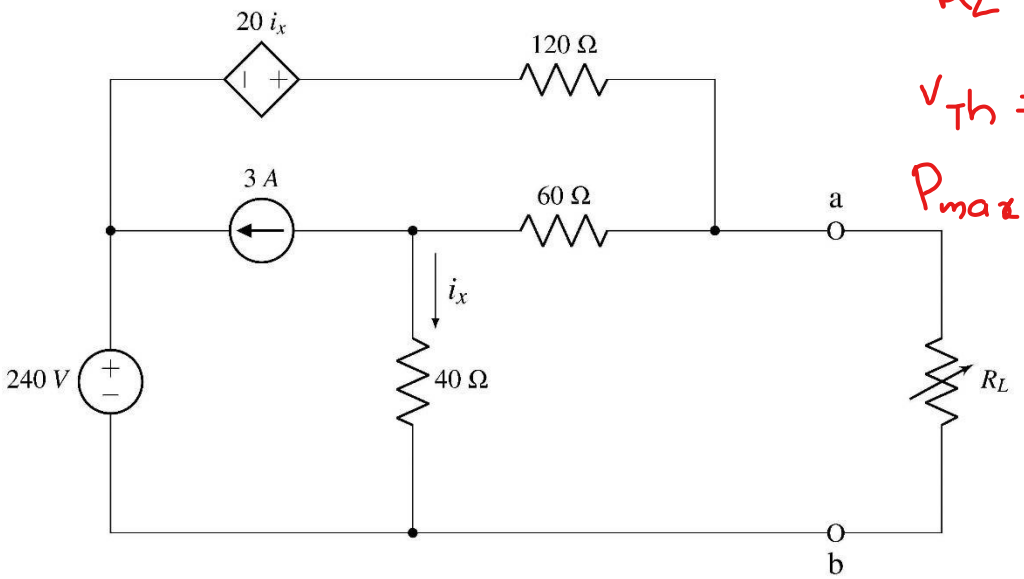
Final Exam
Full marks: 50 (+5 Bonus)
Duration: 2 hours

Question 1 of 3 *[20 marks]*





- **Draw** the **I–V characteristics** of the 5 Ω resistor shown in the circuit above. Please redraw the plot template given above on your script. You must label the axes with appropriate values. *(2 marks) [CO1]*



$R_L = 60\,\Omega$

$V_{Th} = 30\ V$

$P_{max} = 3.75\ W$

- **Determine** the value of R_L that will draw **Maximum Power** from the rest of the circuit. *(10 marks) [CO3, CO4]*
- **Determine** that value of the **Maximum Power**. *(8 marks) [CO2, CO4]*

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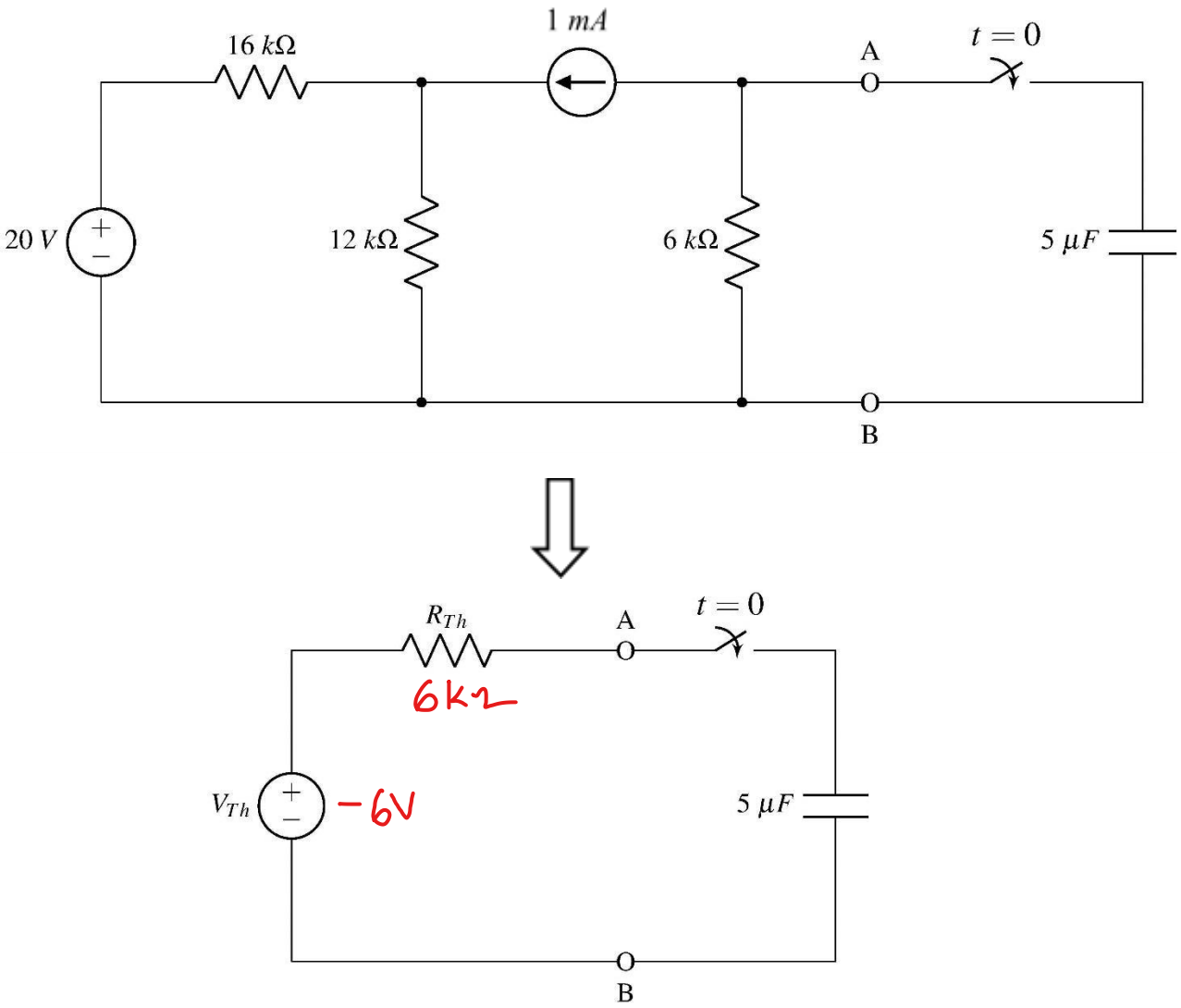
Question 2 of 3 *[20 marks]*



- **Reduce** the first circuit so that it takes the form of the 2nd circuit as shown above. *[Hint: Use Thevenin's principle]*
  (8 marks) [CO4]
- **Perform** transient analysis to determine $v(0), v(\infty),$ *and* $v(t)$ for $t > 0$. Also, determine the **current through the capacitor** at $t = 0.5\ ms$.
  (9 marks) [CO5]

$v(0) = 0V$

$v(\infty) = -6V$

$\tau = 30\ ms$

$v(t) = -6 + 6e^{-t/30}, \quad t > 0$

$t \rightarrow ms$

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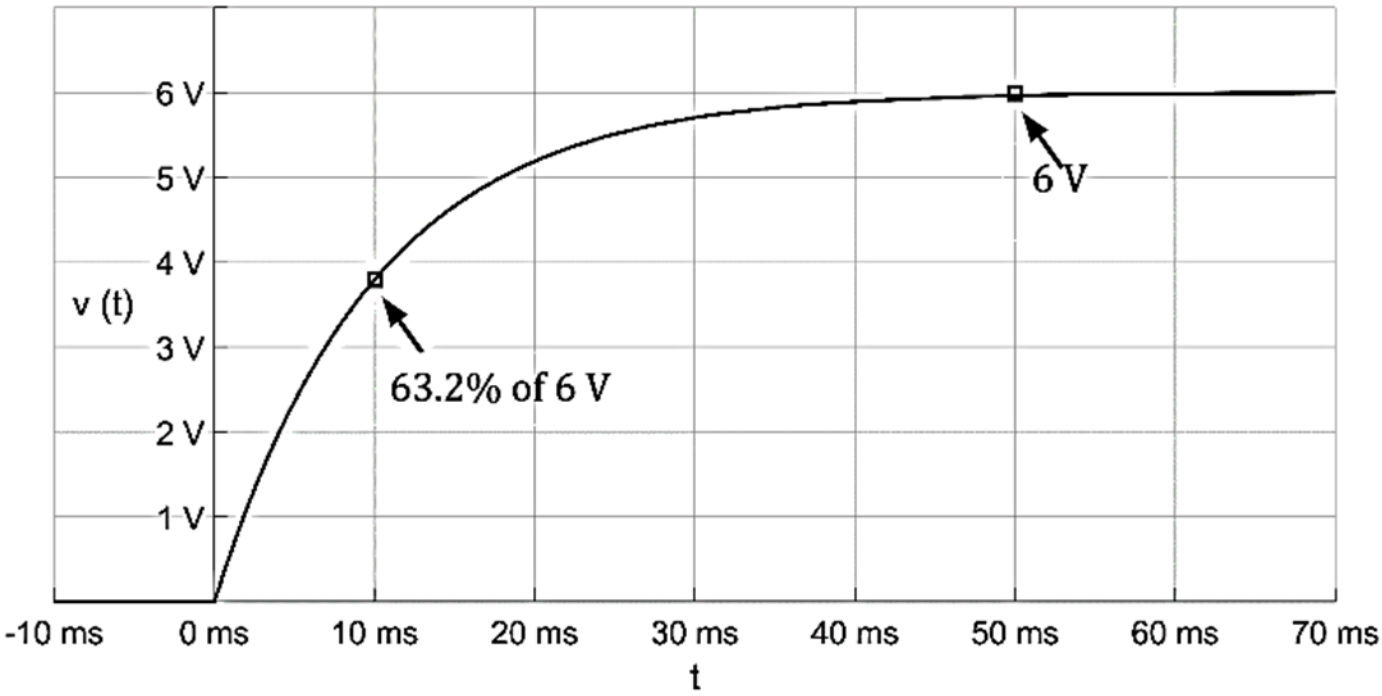
$\tau = 10ms$

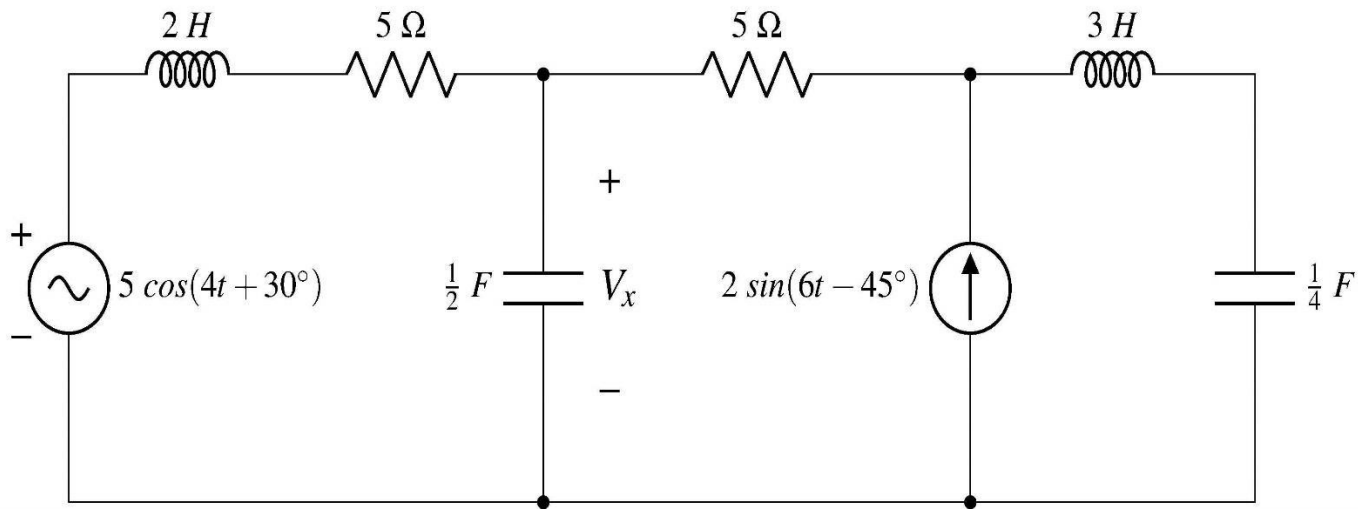
$C = 5\mu F$

$v(t) = 6 - 6e^{-t/10}, \quad t > 0\ ms$



- The figure above shows the voltage response of a series RC circuit to a sudden DC voltage applied through an equivalent resistance of 2 $k\Omega$. **Determine** the approximate **time constant** from the figure. Also, **determine** the value of the **capacitor** used in the RC circuit and find the **expression** for $v(t)$ as only a function of t. *[Hint: Time constant is the time required for the capacitor voltage to reach to 63.2% of its final value from an initially discharged state]*
  (3 marks) [CO5]

Question 3 of 3 *[15 marks]*



- **Determine** the voltage v_x. *[Hint: Use Superposition principle]*
  (15 marks) [CO4, CO6]

$v_x(t) = 0.29\cos(4t - 115.17°) + 0.69\sin(6t - 118.01°)\ (V)$