ID:	Name:

Brac University

Set: 2

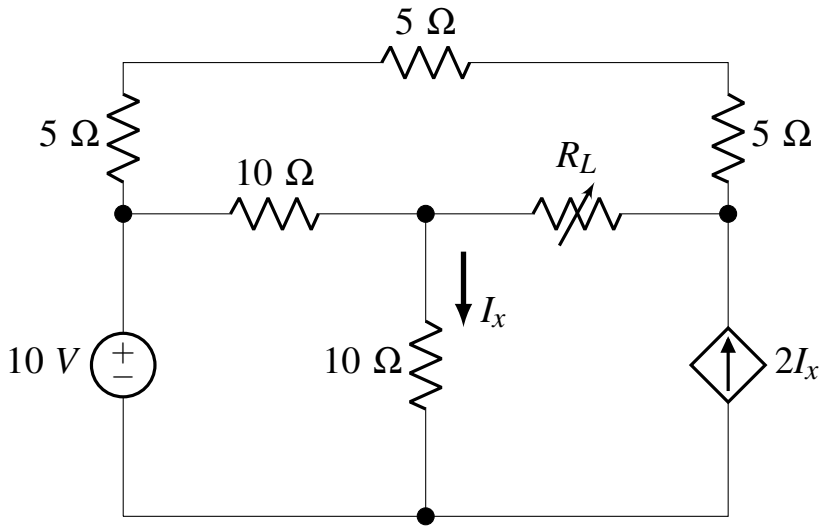
Semester: Fall 2022
Course No: CSE250
Course Title: CIRCUITS AND ELECTRONICS
Date: January 02, 2023

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

Questions 1 to 3 are mandatory. *Numbers inside box brackets indicate marks.*

Question 1 of 4 *[15 marks]* [CO2, CO3, CO4]

Consider the circuit show below.



(i) Ans: $R_L = 5\ \Omega$

(ii) Ans: $V_{Th} = \pm 20\ V$

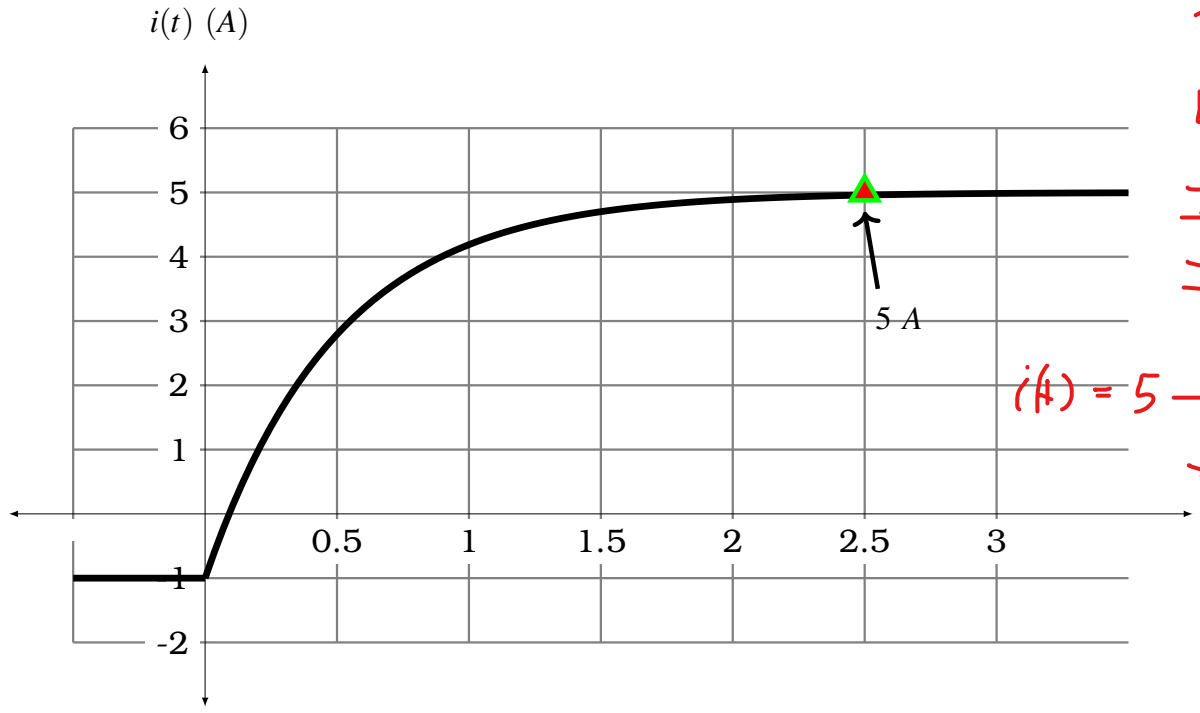
$P_{max} = 20\ W$

(i) **Determine** the value of $\mathbf{R_L}$ that will draw **Maximum Power** from the rest of the circuit. [8]

(ii) **Determine** that value of the **Maximum Power**. [7]

Question 2 of 4 *[20 marks]* [CO4, CO5]

Part A: The figure below shows the current response of a series *RL* circuit to a sudden DC current applied through an equivalent resistance of 6 kΩ. **Determine** the approximate **time constant** from the figure. Also, **determine** the value of the **inductor**. **Write** the mathematical expression of $i(t)$ for $t > 0$. *[Hint: The time it takes for an inductor to be fully charged is approximately five times the time constant].* [3]



$\tau = 0.5ms$

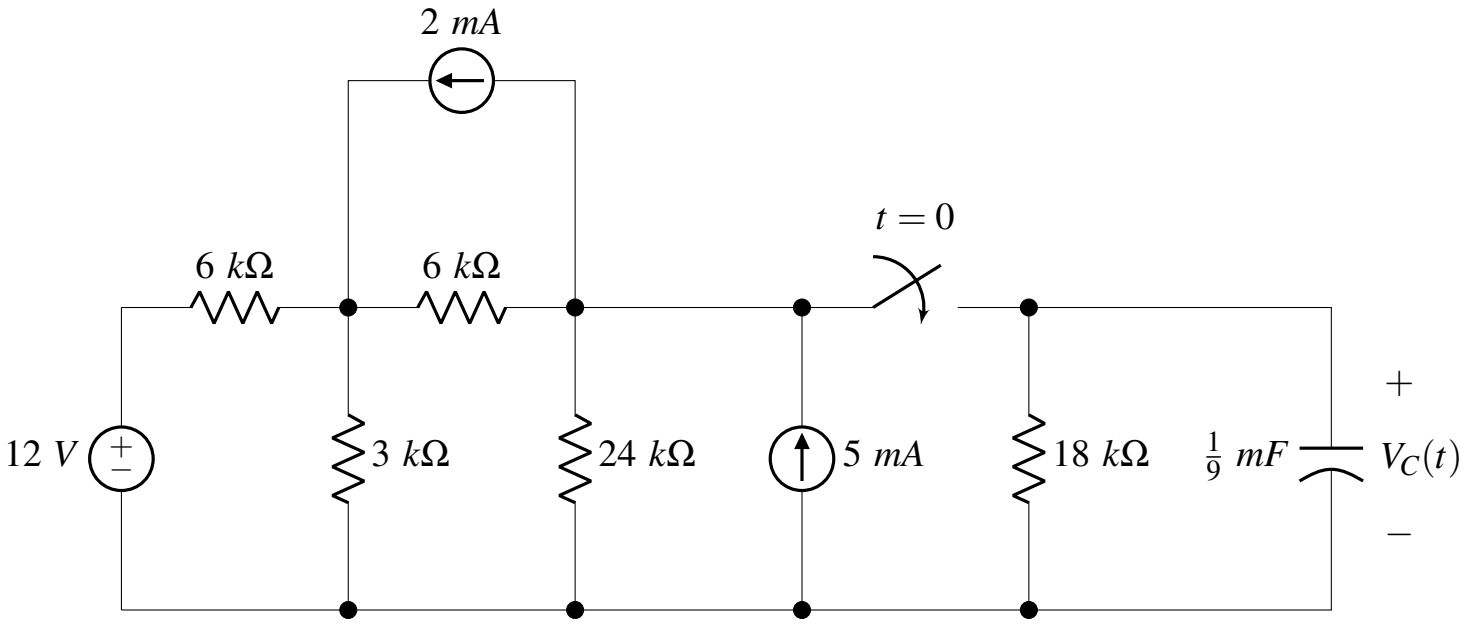
$L = 3H$

$I(0) = -1A$

$I(\infty) = 5A$

$i(t) = 5 - 6e^{-2t}$ (A), $t > 0$, $t \to ms$

Part B: Consider the circuits shown below.



Circuit 1

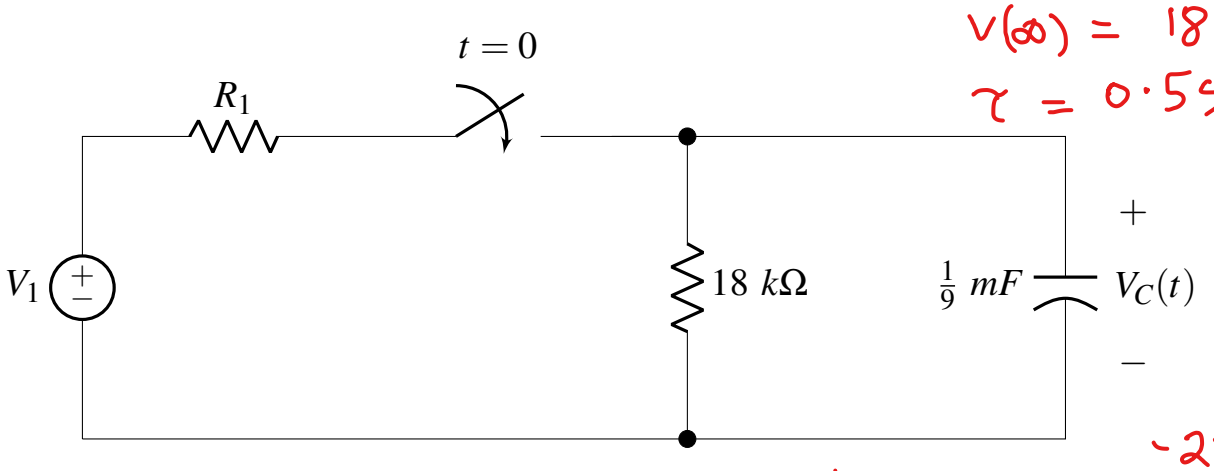
(i) $V_1 = 24V$

$R_1 = 6k\Omega$

(ii) $v(0) = 0V$

$v(\infty) = 18V$

$\tau = 0.5s$



$v_c(t) = 18 - 18e^{-2t}, t>0$

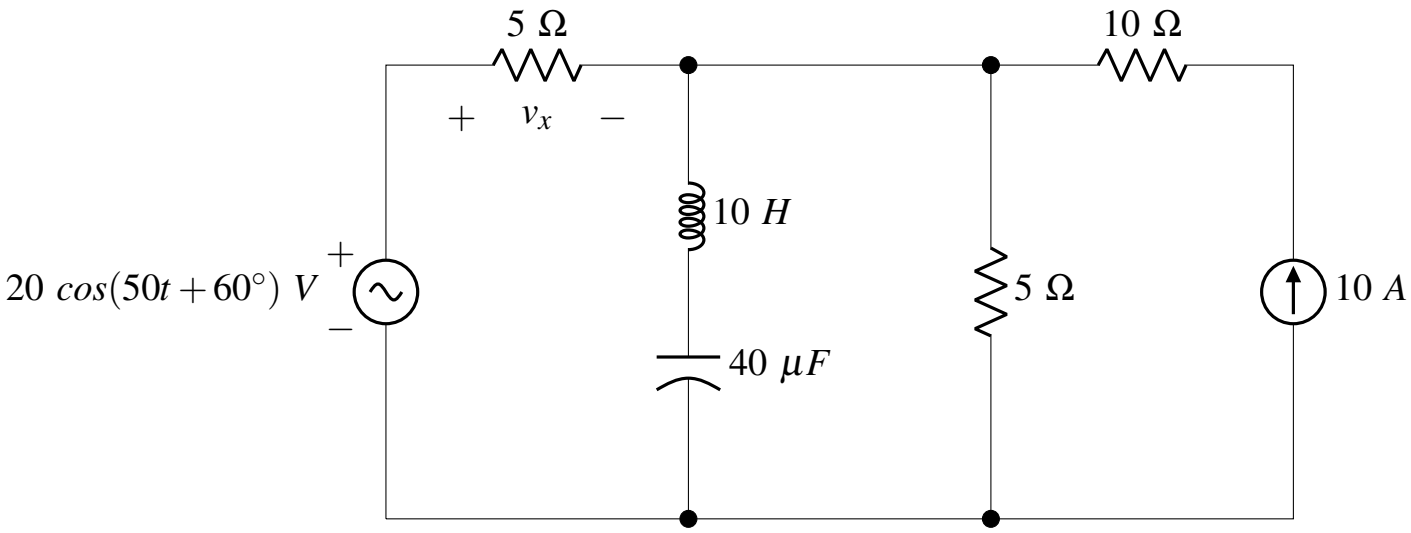
Circuit 2

(i) **Reduce** the circuit 1 so that it takes the form of the circuit 2 as shown above. [8]

(ii) **Perform** transient analysis to determine $V_C(0)$, $V_C(\infty)$, and $V_C(t)$ for t > 0. Also, determine the current through the capacitor at t = 0.64 s. [9]

Question 3 of 4 *[15 marks]* [CO4, CO6]

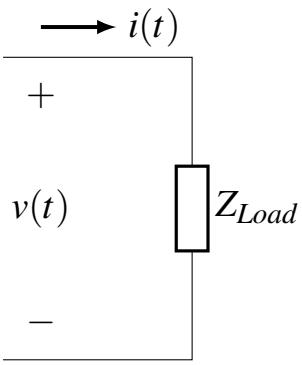
Find v_x in the circuit shown below *[Hint: Use Superposition Principle]*. [15]



$v_x(t) = 20\cos(50t + 60°) - 25$ (V)

Question 4 of 4 *[Bonus] [5 marks]* [CO6]

A series-connected load shown below draws a current $i(t) = 4\ cos(400t - 30°)\ A$ when the applied voltage is $v(t) = -100\ sin(400t - 150°)\ V$. **Determine** with appropriate units



(i) **Complex Power** of the load, [2]

(ii) **Power Factor** of the load, [1]

(iii) **Real** and **Reactive Power** absorbed/supplied by the load. [2]