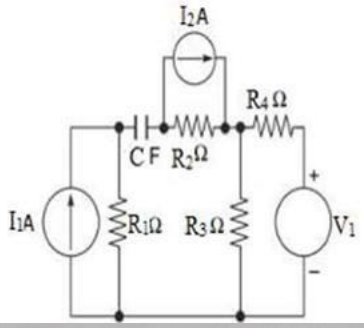
R-L and R-C DC Transient

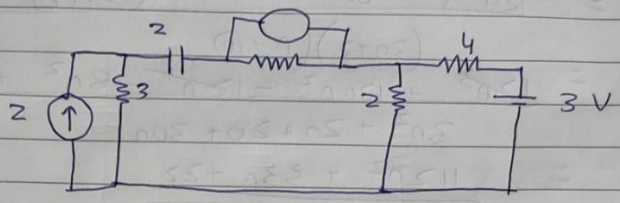
Name: Adwait S Purao
UID: 2021300101
Batch: B2

Question 1:

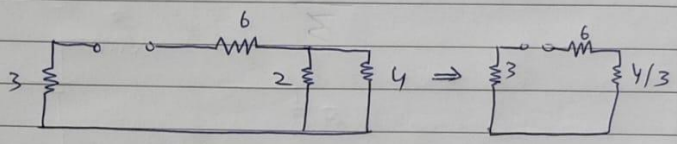
1. Calculate time constant for the given circuit. R_1= 3, R_2=6, R_3=2, R_4=4, C=2, V_1=3V, I_1=2A, I_2=4A



Q.1



R_{eq} :



$R_{eq} = 3 + 6 + (2 \| 4)$

$= 9 + \frac{4}{3}$

$= \frac{27 + 4}{3}$

$= \frac{31}{3}\ \Omega$

$\therefore R_{eq} = 10.33\ \Omega$

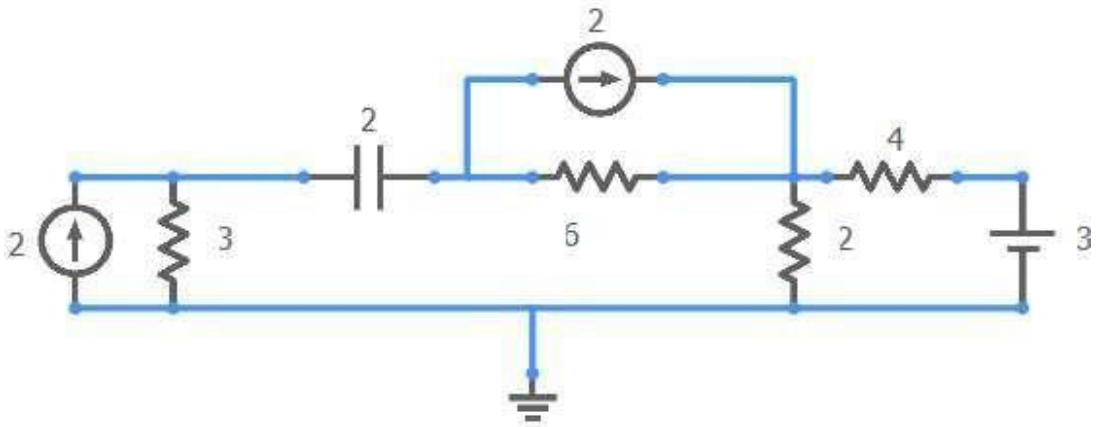
τ = Time constant = RC

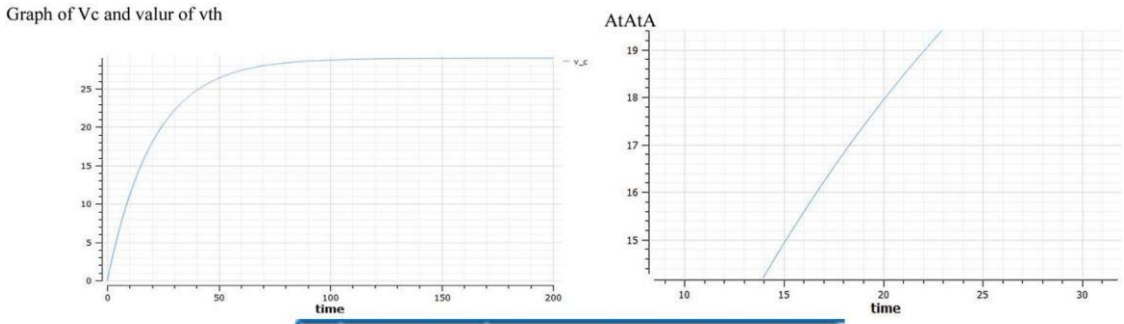
$= (10.33)(2)$

$= 20.66\ s$

$\therefore \tau = 20.66\ s$

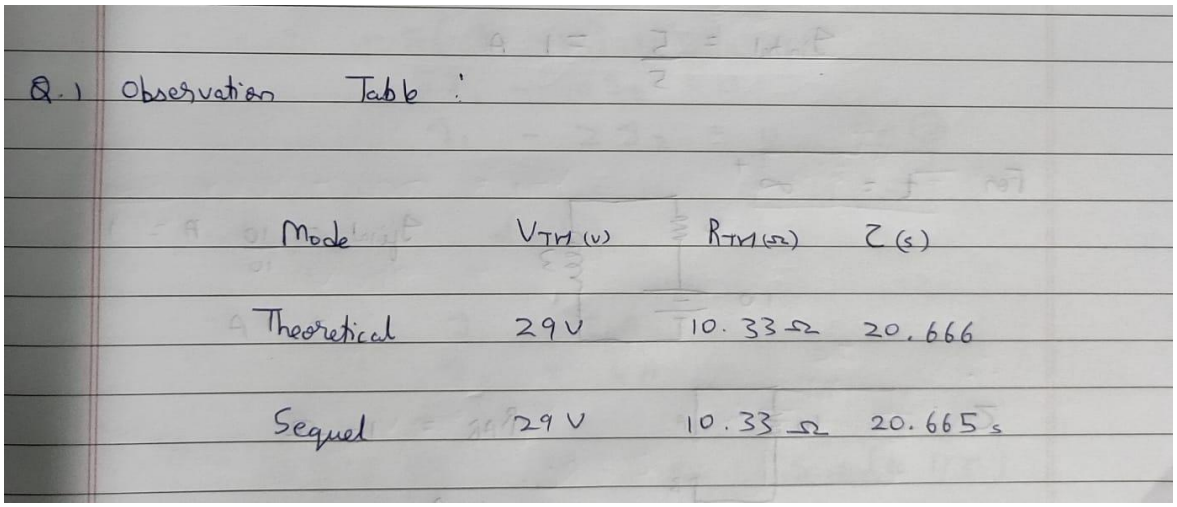
Sequel Solution:





	Variable	Value
1	Vth	-2.900000e+001

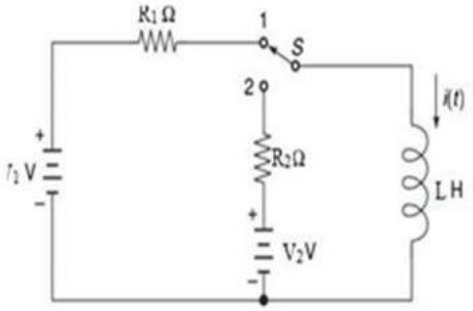
At 63% of voltage reached the time is 20 sec which matches the theoretical value of Time constant. Also the value of V_{Th} matches the peak voltage.

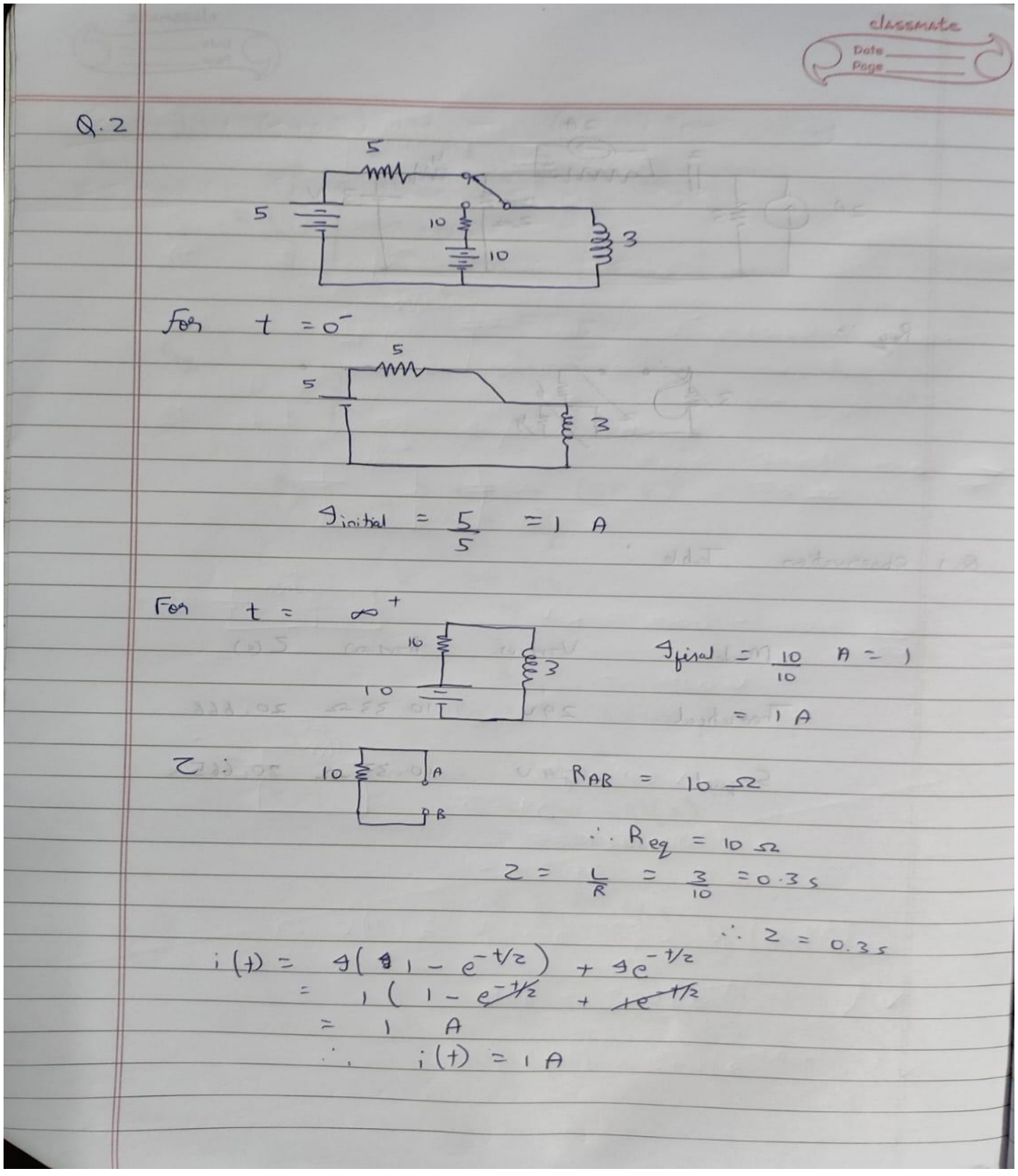

Q.1 Observation Table :

Mode	V_{TH} (V)	R_{TH} (Ω)	τ (s)
Theoretical	29 V	10.33 Ω	20.666
Sequel	29 V	10.33 Ω	20.665 s

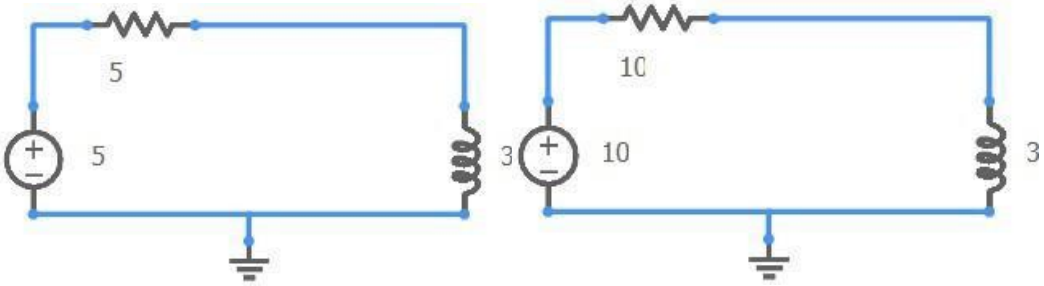
Question 2:

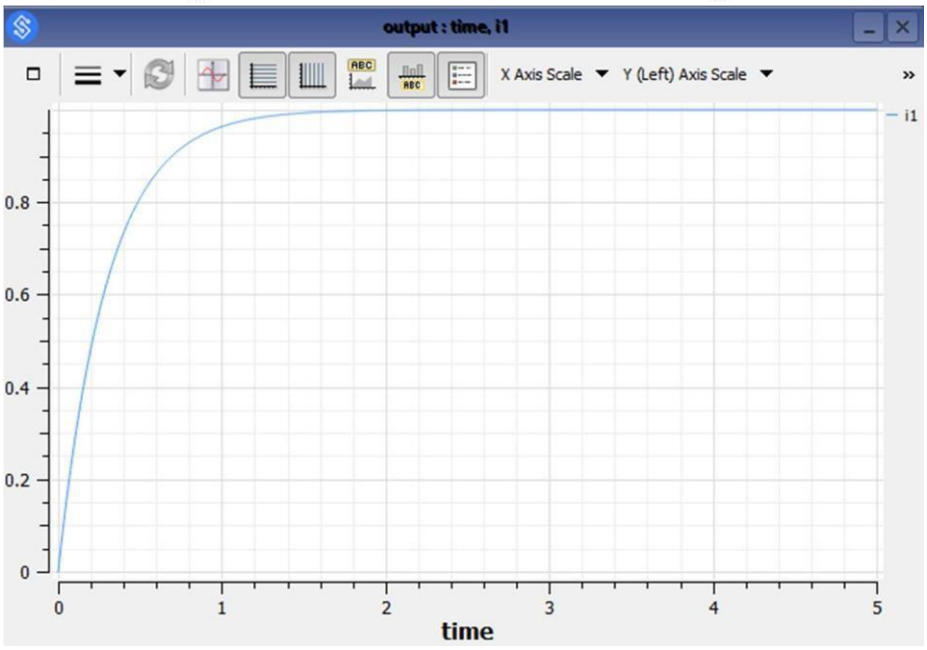
2. The switch S has been in position 1 for long time. It is thrown to position 2 at t=0. Compute i(t). R_1= 5, R_2= 10, L= 3, V_1= 5, V_2=10





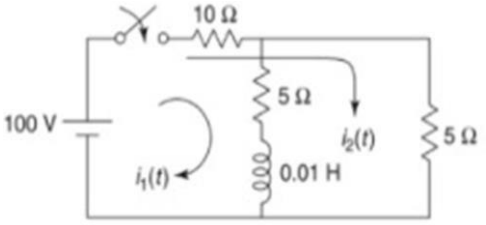
Sequel Solution:

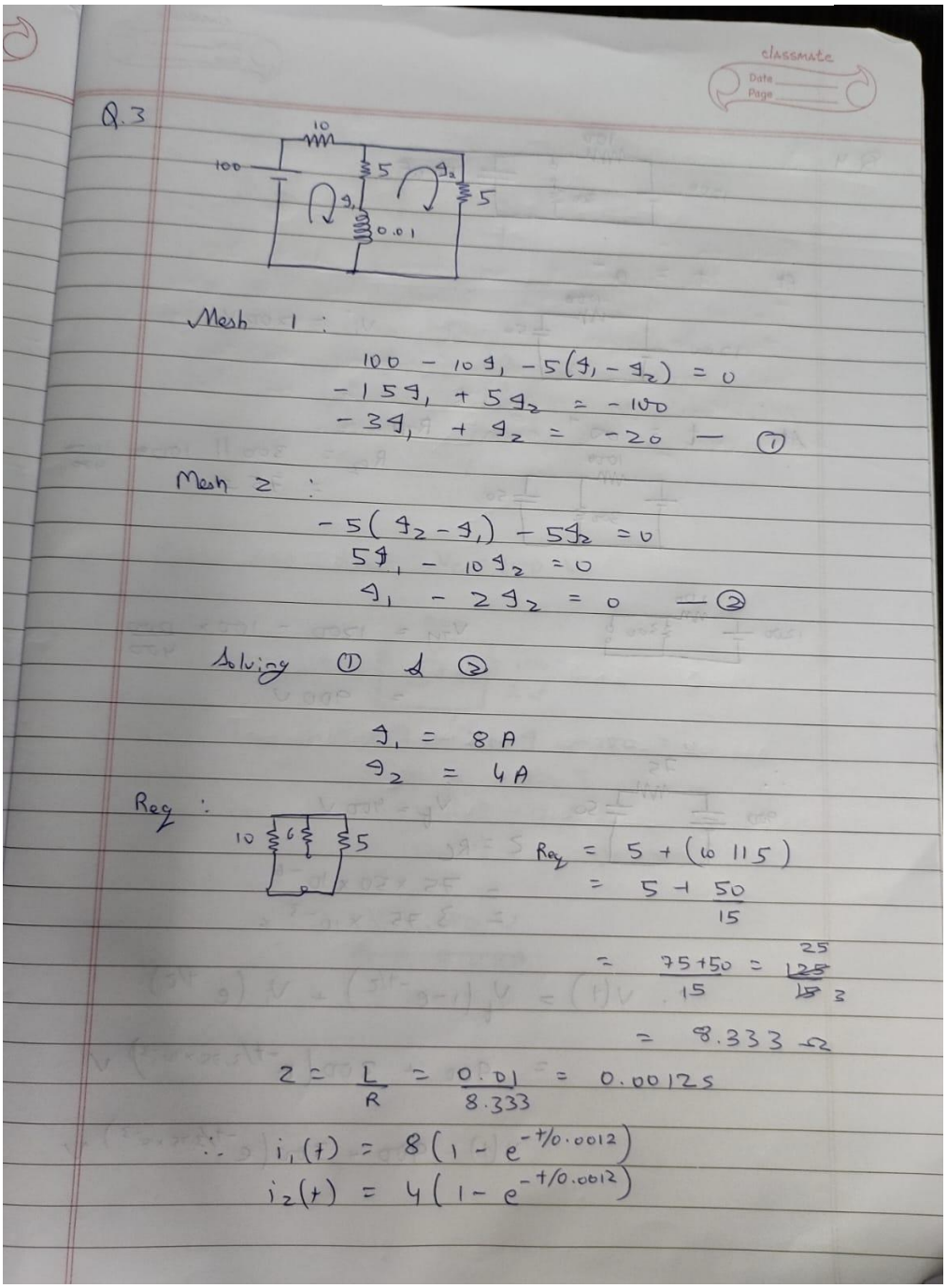




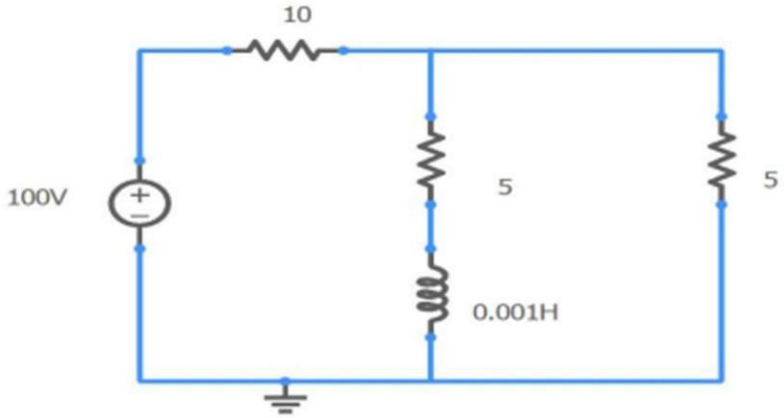
Question 3:

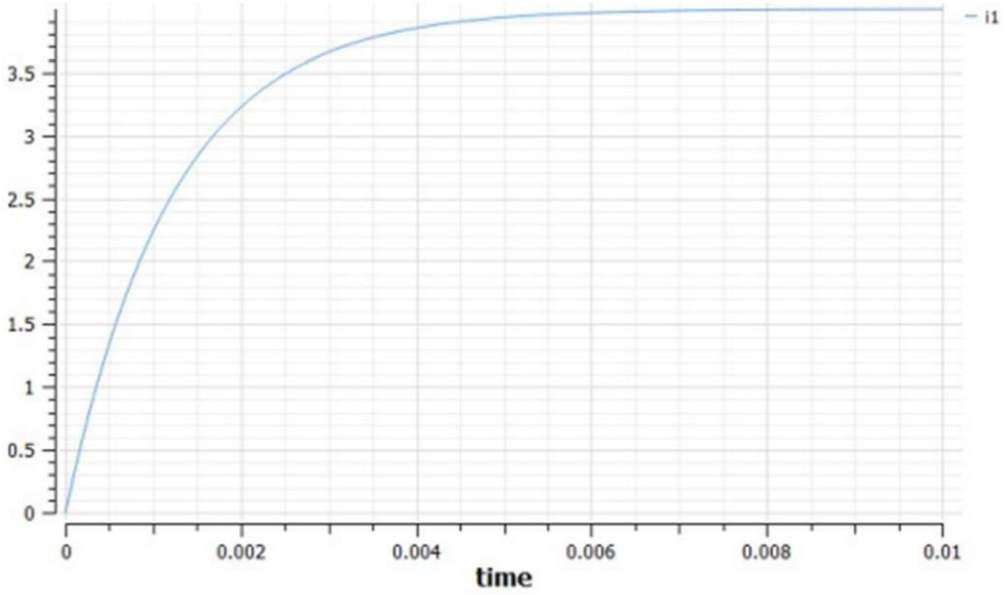
3. Calculate $i_1(t)$ and $i_2(t)$ when switch is closed at t=0.





Sequel Solution:

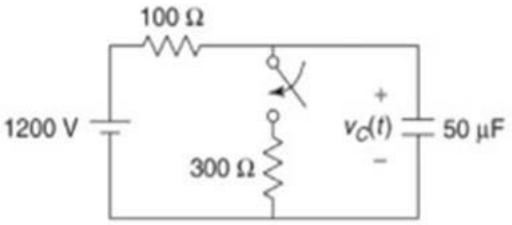


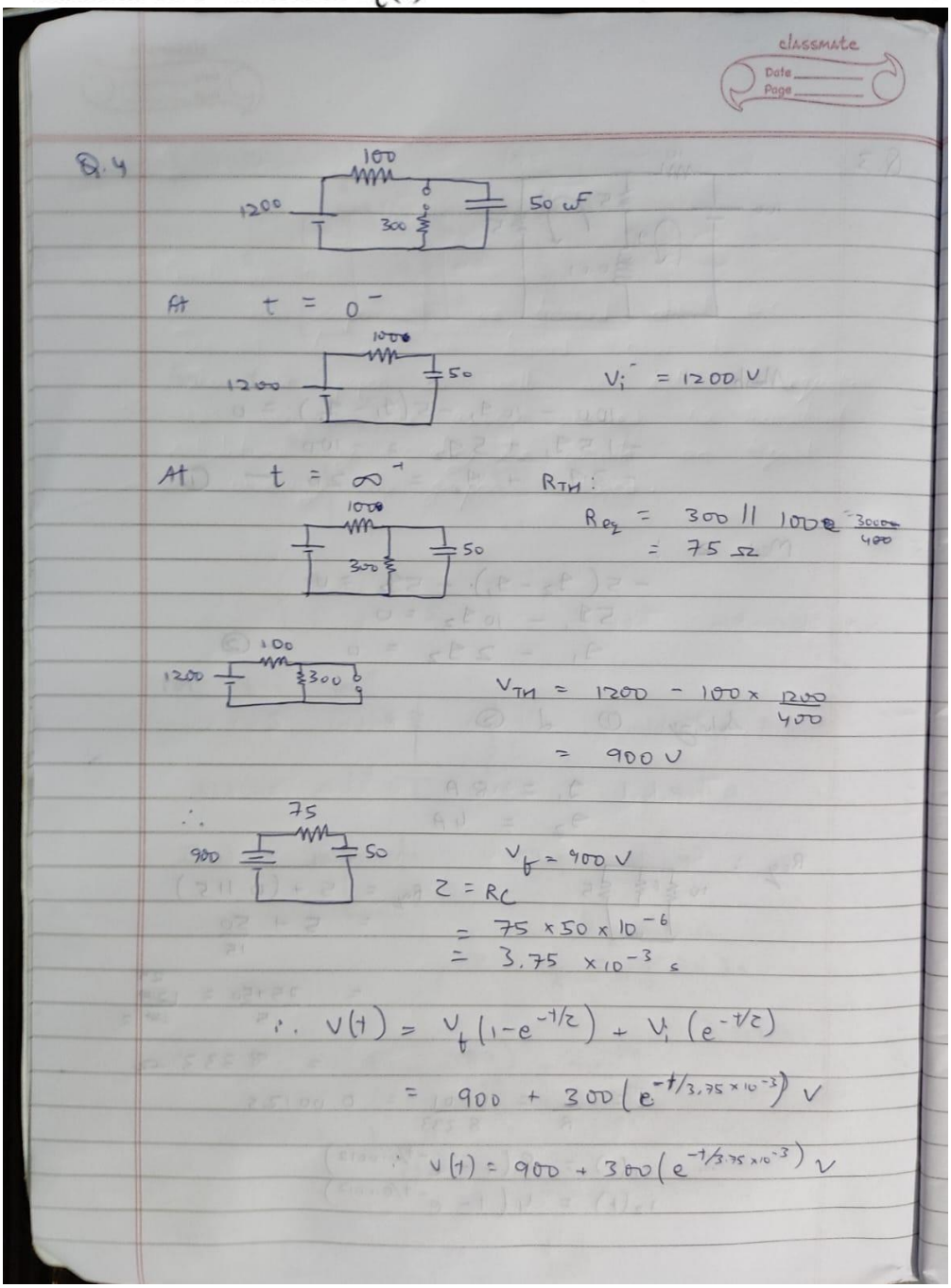


The peak value of current of both, the theoretical and sequel implemented circuits come out to be 4A

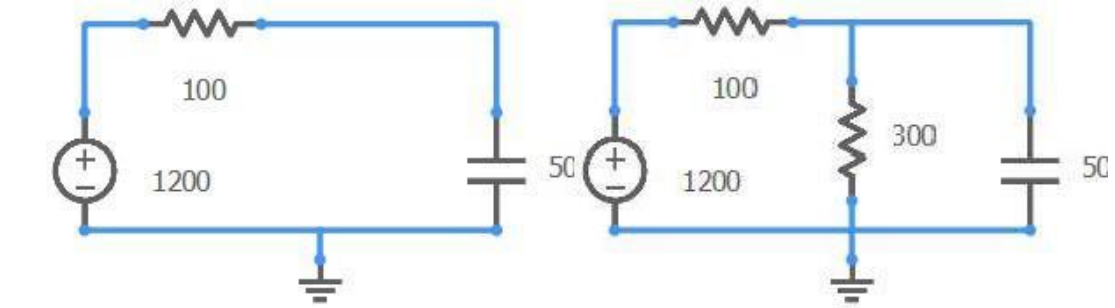
Question 4:

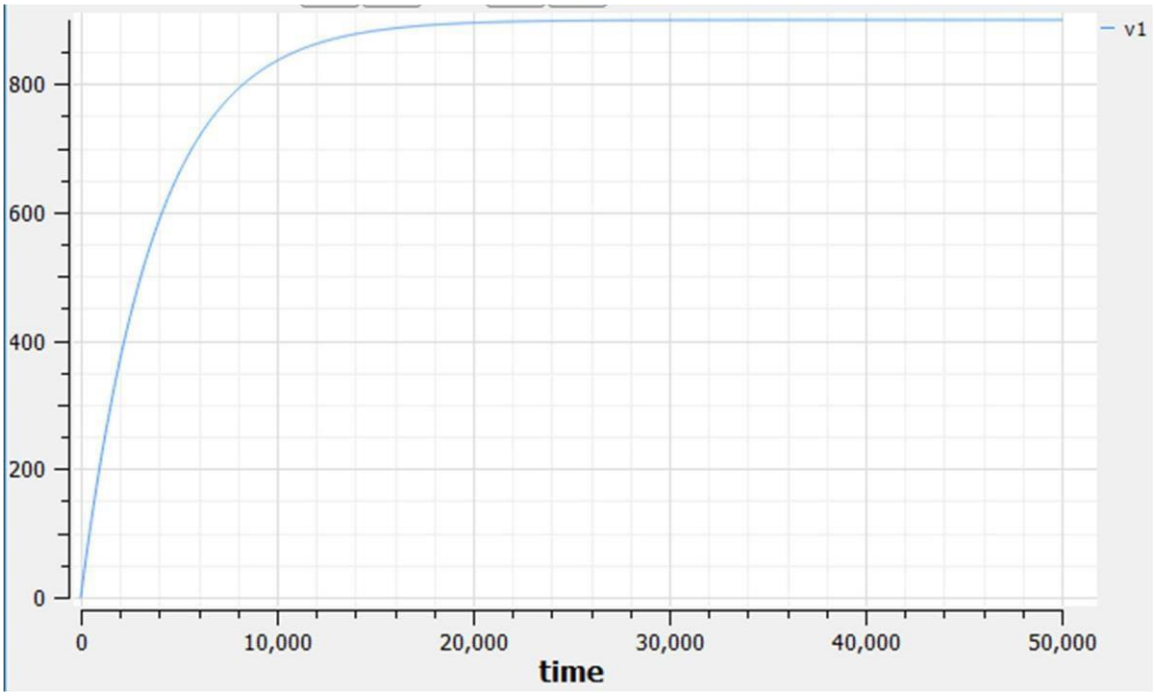
4. The switch is opened for long time and it has been closed at t=0. Find $v_c(t)$





Sequel Solution:

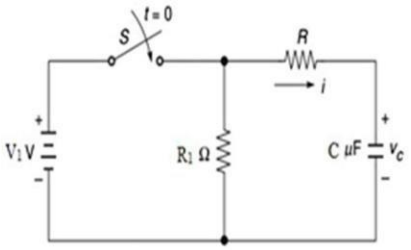


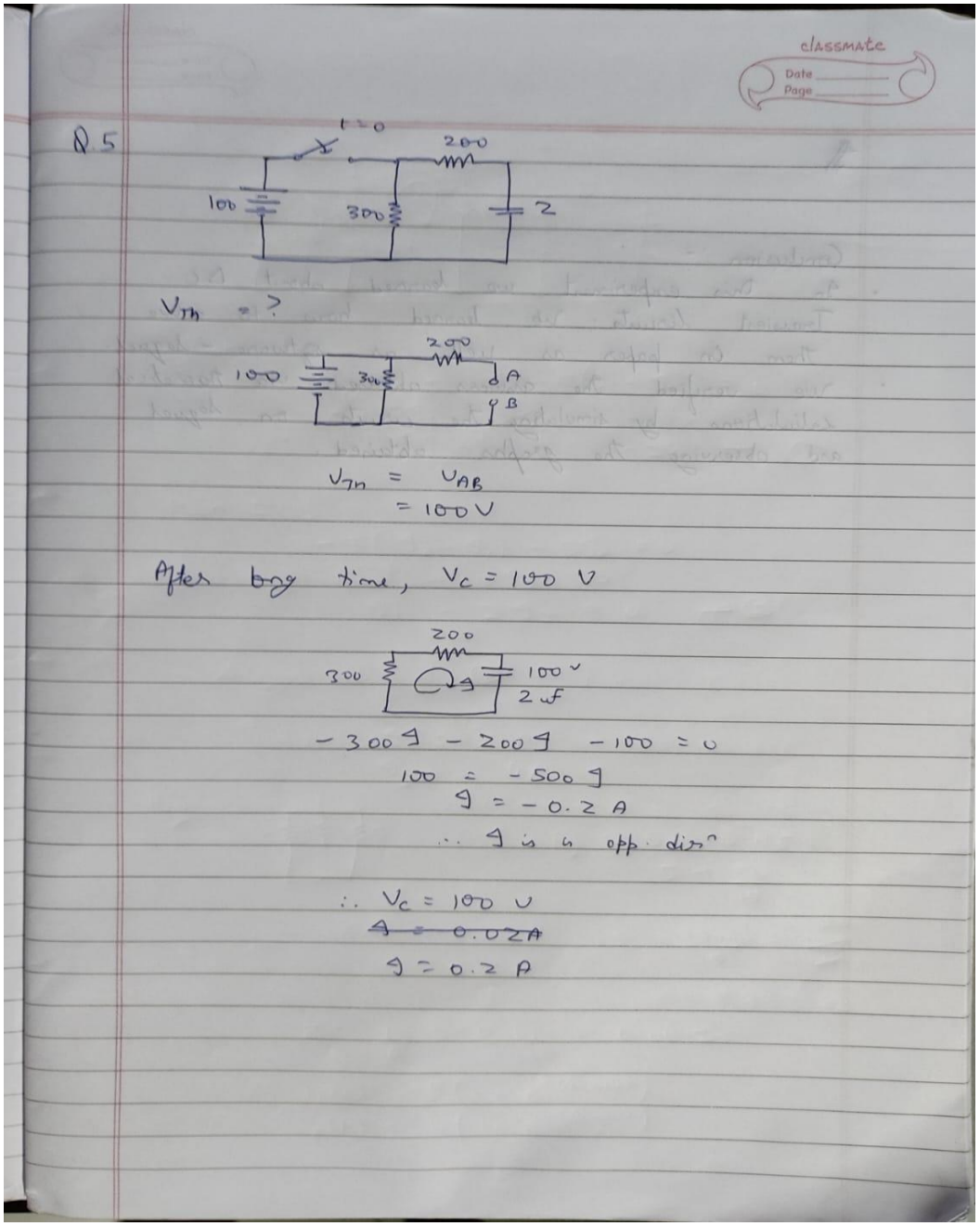


The final value of voltages both, the theoretical and sequel simulation comes to 900V.

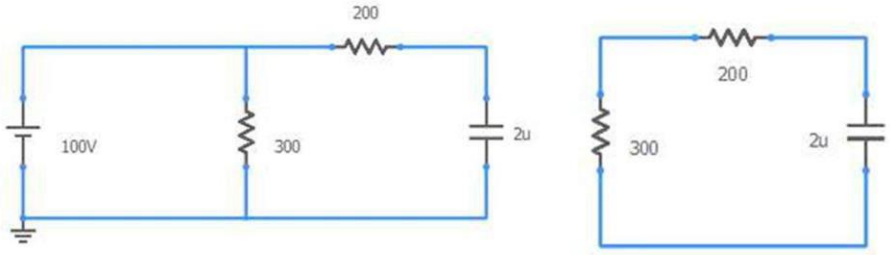
Question 5:

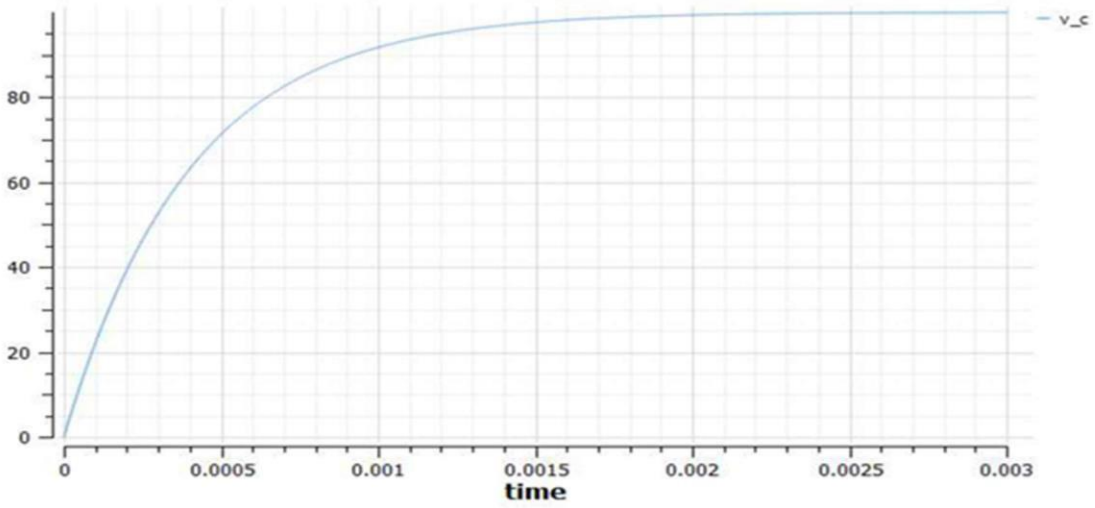
5. The switch has been closed for long time. Calculate v_c and i if switch is thrown open. V_1= 100, R_1= 300, R= 200, C=2

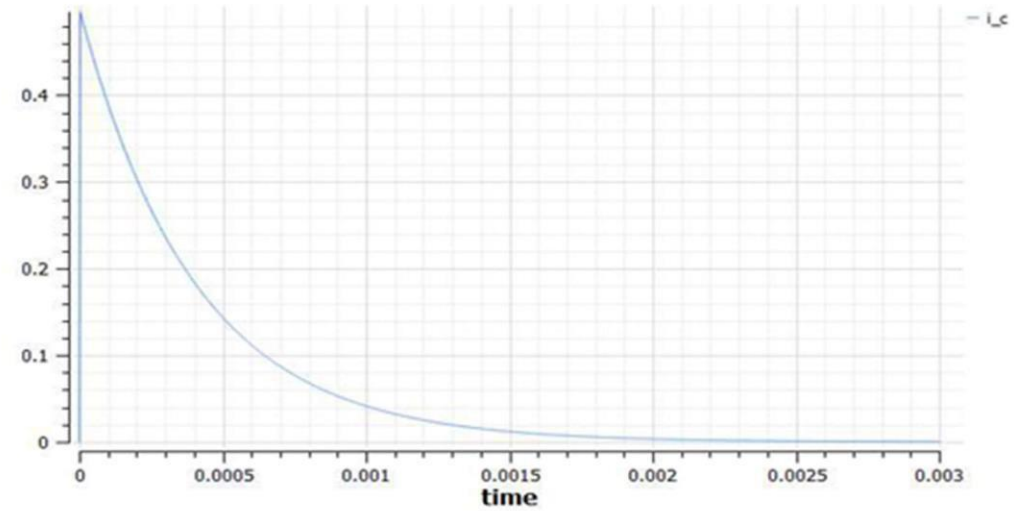




Sequel Simulation:







Name	V-C	i
Sequel	100V	0.2A
Theoretical	100V	0.2A

EXPERIMENT No: 4 **DATE: 10 / 07 / 2022**

R-L and R-C DC Transient response

AIM: To verify DC Transient response for the given R-L an R-C circuits.

APPARATUS AND COMPONENTS REQIRED: Sequel Simulator

THEORY: Write theory related with following questions:

1) Define time constant, initial condition, final condition, transient response, natural response, forced response.

Time Response: The time required for a changing quantity in a circuit, as voltage or current, to rise or fall approximately 0.632 of the difference between its old and new value after an impulse has been applied that induces such a change: equal in seconds to the inductance of the circuit in henries divided by its resistance in ohms.

Initial Condition: The values of the dependent variable (current and voltage) and their higher derivatives just after the instant of switching are known as an initial conditions.

Final Condition: The values of the dependent variable (current and voltage) and their higher derivatives at a very long time after the instant of switching are known as an final conditions.

Transient Conditions: a transient response or natural response is the response of a system to a change from equilibrium

Natural Response: The natural response of a circuit is what it does "naturally" as its internal energy moves around. As the energy sloshes around we track what happens to voltage and current.

Forced Response: The forced response is where the output (the voltage on the capacitor) is going to end up in the long run after all stored energy eventually dissipates.

PROCEDURE:

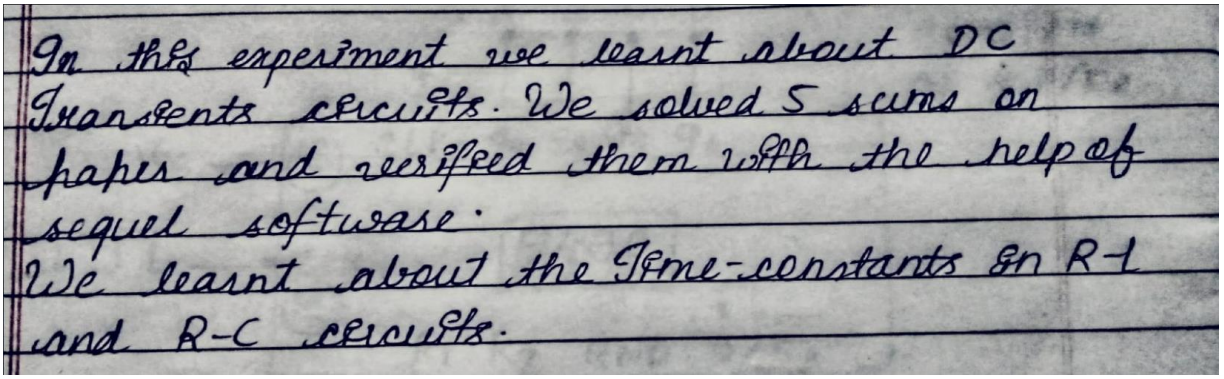
1) Solve the problems given in below table (as per your batch e.g. X1= A1/B1/C1) to obtain transient response of R-L and R-C circuits

2) Verify the solution of the problems solved in step 1 using Sequel software.

RESULT:

Problem no.	Parameter	Theoretical	Practical
1	Time Constant	20.667 s	20.665 s
2	Current	1 A	1 A
3	Current	4 A	4 A
4	Voltage	900 V	900 V
5	Voltage and Current	100 V, 0.2 A	100 V, 0.2 A

CONCLUSION:



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Bharatiya Vidya Bhavan's

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India

(Autonomous College Affiliated to University of Mumbai)

Applied Science and Humanities Department