(A 4) Problem Statement :

Using Eulers method, compute current and charge by solving the following pair of equations within time interval 0 to 0.1 sec with a step size of 0.01 se with the help of following paramiters

(i) initial current ($i(0)$) = 0
(ii) initial charge ($q(0)$) = 1C
(iii) inductance (L) = 5H
(iv) resistance (R) = 200Ω
(v) capacitance (C) = 10^{-4} F

equations, $iR + L\frac{di}{dt} + \frac{q}{C} = 0$ and,

$$\frac{dq}{dt} = i$$

knowns,

$i(0) = 0$ (initial current)
$q(0) = 1C$ (initial charge)
$L = 5H$ (inductance)
$R = 200\Omega$ (resistance)
$C = 10^{-4}$ F (capacitor)
$t \in [0, 0.1]$ sec (time interval)
$h = \Delta t = 0.001$ sec (step size)

unknowns,

$i(t) = ?$ where $t \in [0, 0.1]$
(current at time (sec) within t and stepsize 0.001 sec)
$q(t) = ?$ where $t \in [0, 0.1]$
(~~current~~ charge at time (sec) within t and stepsize 0.001 sec)

Sol^n:

$$iR + L\frac{di}{dt} + \frac{q}{C} = 0 \quad \text{and} \quad \frac{dq}{dt} = i \quad \text{—— given}$$

$$(i_0)' = \left(\frac{-q}{C} - iR\right)\frac{1}{L} \quad \text{and} \quad (q_0)' = i_0$$

$$(i_0)' = \left(\frac{-1}{10^{-4}} - 0(200)\right)\frac{1}{5} \quad \text{and} \quad (q_0)' = 0$$

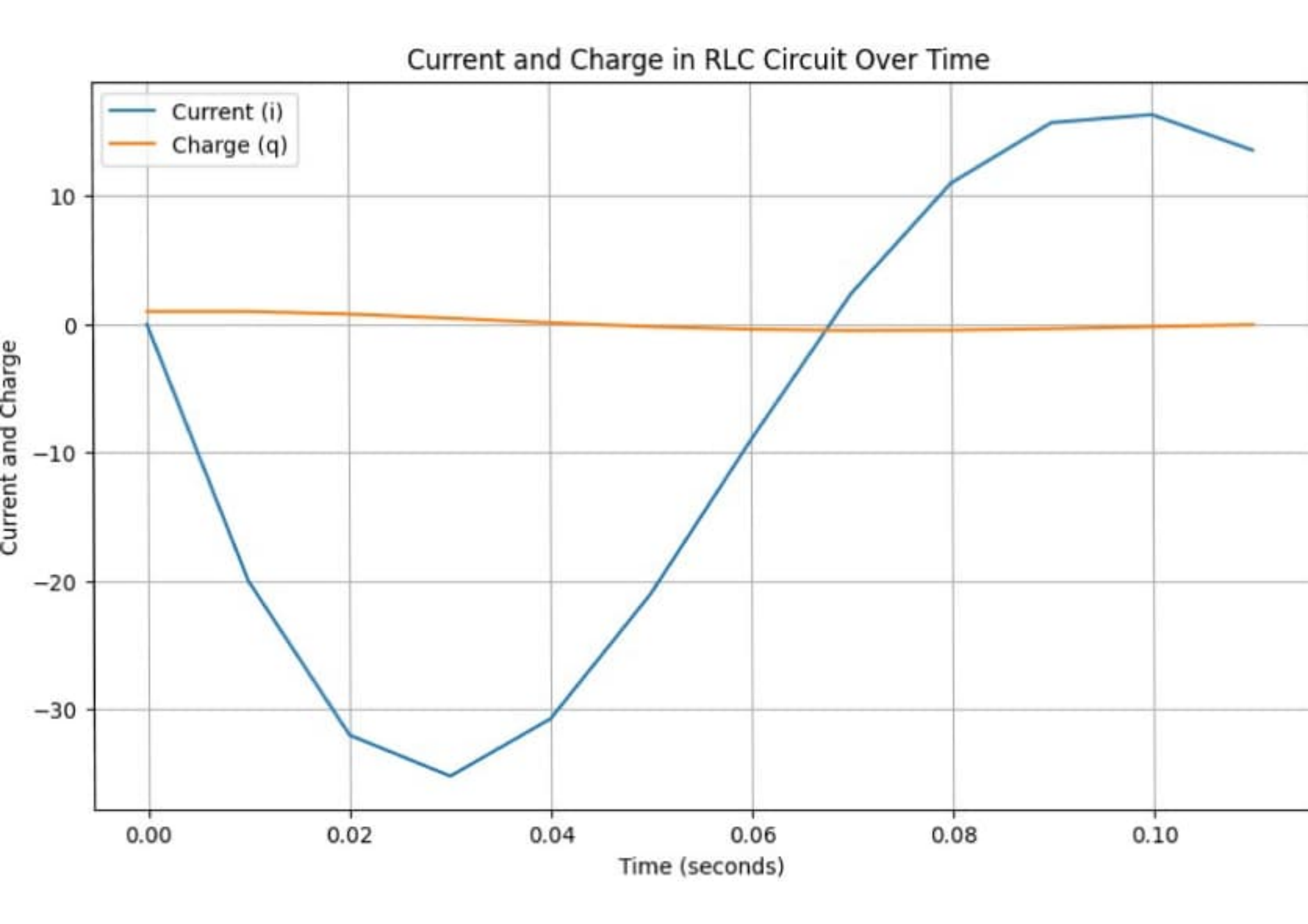
$$V_{i+1} = V_i + hf(V_i) \quad \text{—— from euler's method.}$$

(i) $$i_1 = i_0 + hf(i_0)$$
$$= 0 + (0.001)\left[\frac{1}{5}\left(\frac{-1}{10^{-4}} - 0\right)\right]$$
$$= 0.001 \times \left(\frac{-10000}{5}\right)$$
$$= -20 \text{ amp}$$

(ii) $$q_1 = q_0 + hf(q_0)$$
$$= 1 + (0.001)(0)$$
$$= 1C$$

assumptions,

① System behave as idea (curcisit, etc)


Current and Charge in RLC Circuit Over Time
Current (i)
Charge (q)
10
0
−10
−20
−30
Current and Charge
0.00
0.02
0.04
0.06
0.08
0.10
Time (seconds)