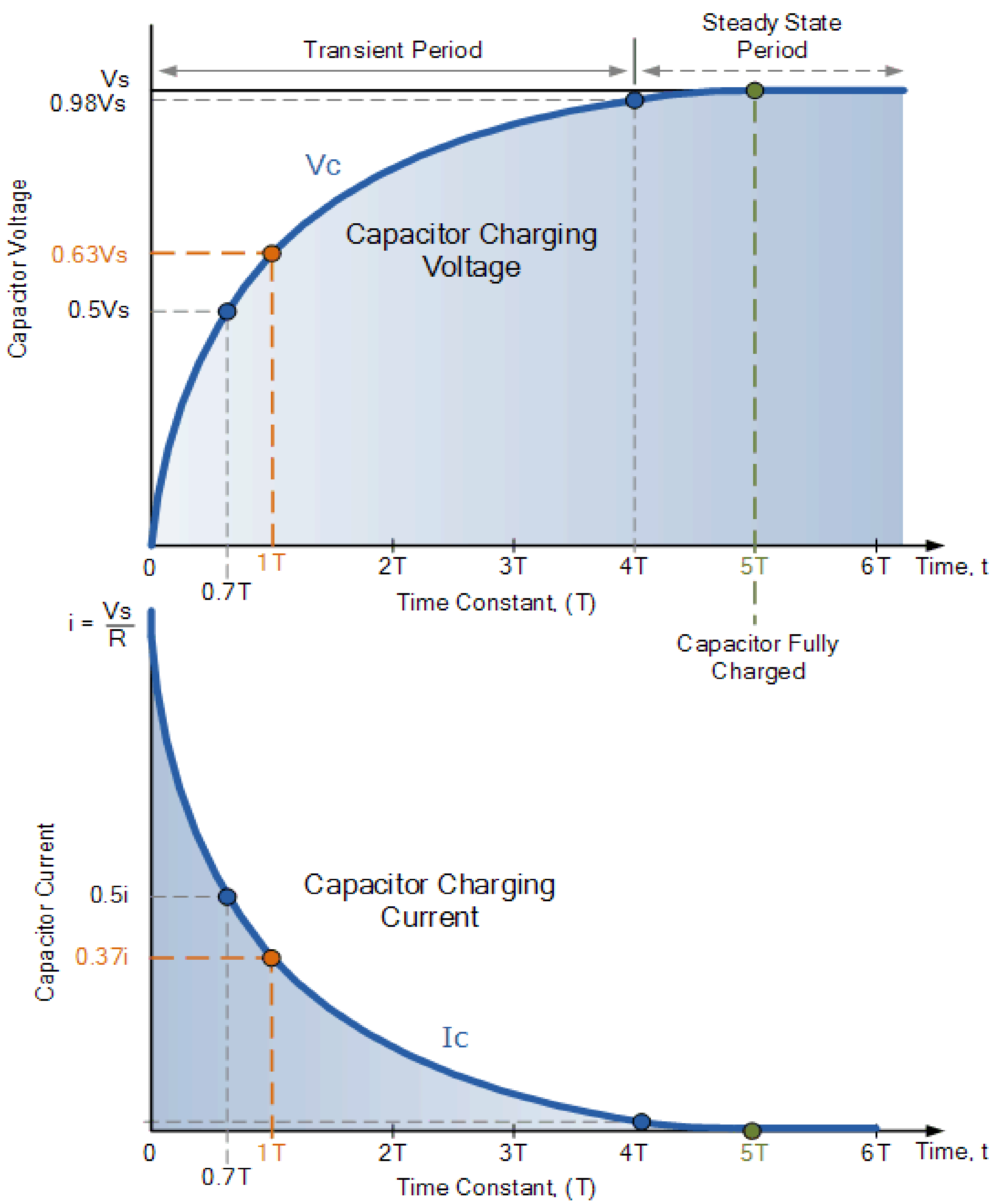
ACCELERATION CONTROL

Since the design consideration was for 9s, the electric team used an RC circuit to apply the required delay.

An RC circuit induces a specified delay in a circuit by utilizing the charging principle of a capacitor. A capacitor charges to near full state in 5-time constants.

$$v = v_0(1 - e^{\frac{-t}{RC}})$$



Therefore, in order to design for a 9s charge delay, the time constant of the capacitor should be $\frac{1}{5}$ of the required full delay.

$$\tau = RC$$

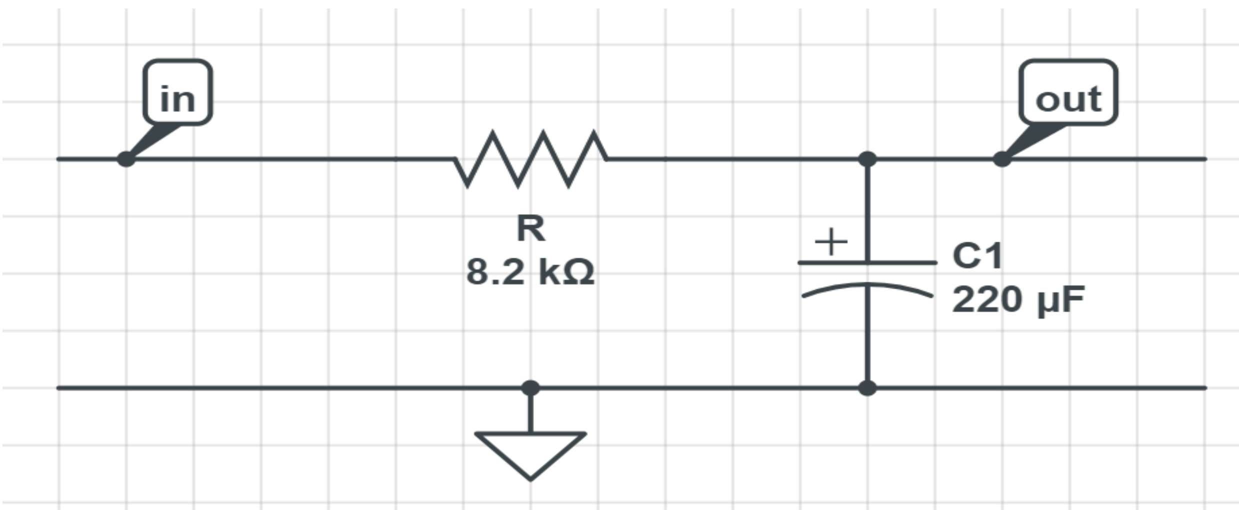
$$\tau = \frac{Delay}{5} = \frac{9}{5} = 1.8s$$

Let the capacitor value of the delay circuit be 220µF as it is a common capacitor value:

$$R = \frac{\tau}{C}$$

$$R = \frac{1.8}{220\mu F} = 8.1818181\ k\Omega$$

The closest standard resistor value is 8.2 kΩ



ACCELERATION MODEL OF THE TRICYCLE

$$v = v_0(1 - e^{\frac{-t}{RC}})$$

$$n \propto v$$

$$n = kv$$

$$n = k\ x\ v_0(1 - e^{\frac{-t}{RC}})$$

Let $k\ x\ v_0$ be n_0

$$\mathrm{n} = n_0(1 - e^{\frac{-t}{RC}})$$

$$\frac{ds}{dt} = n_0(1 - e^{\frac{-t}{RC}})$$

$$\frac{d^2s}{dt^2} = \frac{n_0}{RC} e^{\frac{-t}{RC}}$$

Power = Force × velocity

Power = mass x acceleration x velocity

Power= m × $\{\frac{n_0}{RC} e^{\frac{-t}{RC}}\}$ × $\{n_0(1 - e^{\frac{-t}{RC}})\}$

Where in our specific case:

$v_0 = 5V$

$k = \frac{8}{9}$

$n_0 = 4.4444444\ m/s$

$\tau = RC = 1.8s$