Experiment - 1

Aim :- To study the time response of a simulated linear system

Software Used : MATLAB

Theory :- If the output of control system for an input varies with respect to time then it is called time response of the system. It consist of two parts?

- **Transient Response :** After applying input to control system, output takes certain time to reach steady state. So the output will be in transient state till it goes to a steady state. Therefore the responses of control system during transient state is known as transient response.

- **Steady State Response :** The part of time response that remains even after the transient response has zero value for large value of 't' is known as steady state response.

Rise Time : Time required for the response to rise from 10% to 90% of the final values in over damped system. It is denoted by t_r.

Settling Time : Time required for the response to reach steady state i.e from 0% to 98% of its final value. It is denoted by t_s.

Natural Response: It is the system response to initial condition with all external forces set to zero.

Forced Response: It is the system response to an external stimulus with zero initial conditions.

Eg let us take $C(s) = \dfrac{a}{s(s+a)}$ then

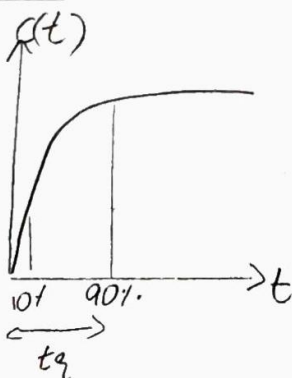$$c(t) = \underset{\underset{\text{Forced response}}{\downarrow}}{1} - e^{-at} \rightarrow \text{natural response.}$$

Now $t_q = c(t)_{90\%} - c(t)_{10\%}$

$$= \frac{2.31}{a} - \frac{0.11}{a} = \frac{2.2}{a} = 2.2 \times (\text{Time const})$$
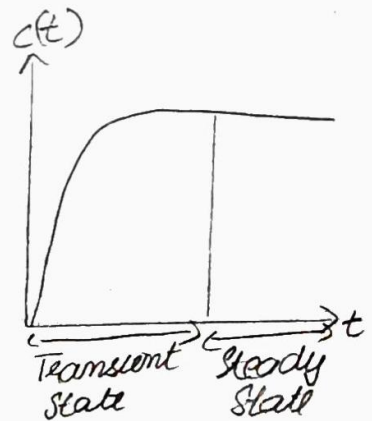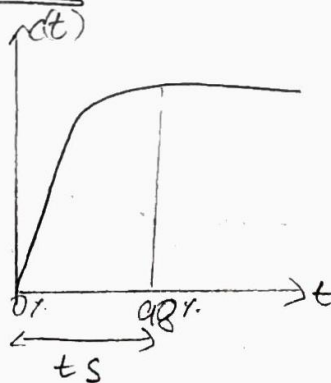
$t_s = c(t)_{98\%} - c(t)_{0.1}$

$$= \frac{4}{a} = 4 \times (\text{Time const}); \text{ where } a \text{ defines the speed of system}$$

RISE TIME :

SETTLING TIME

$c(t)$

Transient State   Steady State

Result: Hence we have studied the time response of a simulated linear system.