



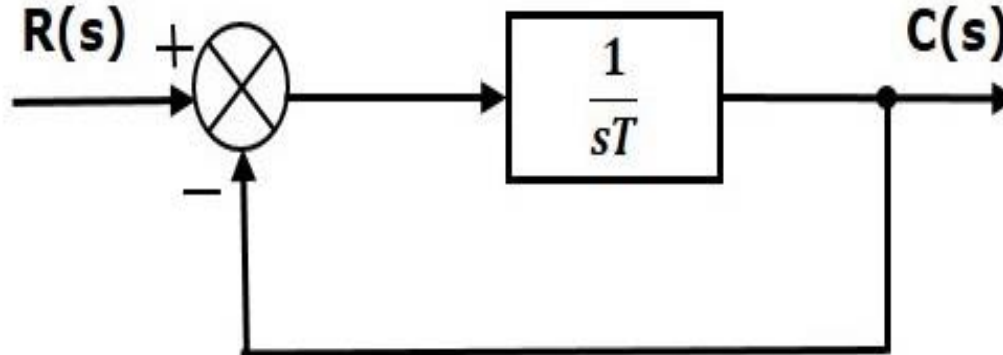
UNIT II

FIRST ORDER RESPONSE



INTRODUCTION

- Consider the following block diagram of the closed loop control system. Here, an open loop transfer function, $1/sT$ is connected with a unity negative feedback. The system is called as first order system.





FIRST ORDER RESPONSE

- The closed loop transfer function of the system is given by,

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1 + G(s)}$$

- Substituting the transfer function for first order system in above equation,

$$\frac{C(s)}{R(s)} = \frac{\frac{1}{sT}}{1 + \frac{1}{sT}} = \frac{1}{sT + 1}$$

$$R(s) = \frac{1}{s}$$



FIRST ORDER RESPONSE

$$C(s) = \left(\frac{1}{sT + 1} \right) \left(\frac{1}{s} \right) = \frac{1}{s(sT + 1)}$$

$$C(s) = \frac{1}{s(sT + 1)} = \frac{A}{s} + \frac{B}{sT + 1}$$

$$C(s) = \frac{1}{s} - \frac{T}{sT + 1} = \frac{1}{s} - \frac{T}{T(s + \frac{1}{T})}$$

- Applying Laplace inverse transform,

$$c(t) = \left(1 - e^{-\left(\frac{t}{T}\right)} \right)$$

