

## 11.9.5.3

EE23BTECH11062 - V MANAS

**Question:**

A sinusoid  $(\sqrt{2}\sin(t))\mu(t)$ , where  $\mu(t)$  is the step input, is applied to a system with transfer function  $G(s) = \frac{1}{1+s}$ . The amplitude of the steady state output is

**Solution:**

Given  $x(t) = (\sqrt{2}\sin(t))\mu(t)$  as input,

By using Laplace transform,

$$X(s) = \frac{1}{1+s^2} \quad (1)$$

$$Y(s) = G(s) \times X(s) \quad (2)$$

$$Y(s) = \left(\frac{1}{1+s}\right)\left(\frac{1}{1+s^2}\right) \quad (3)$$

By finding inverse Laplace transform of  $Y(s)$ ,

$$y(t) = \frac{e^{-t}}{2} + \frac{1}{2}(\sin(t) - \cos(t)) \quad (4)$$

$$y(t) = \frac{e^{-t}}{2} - \frac{1}{\sqrt{2}}\left(\sin\left(\frac{\pi}{4} - t\right)\right) \quad (5)$$

So at steady state (at  $t \rightarrow \infty$ ) the amplitude of output will be  $\frac{1}{\sqrt{2}}$