# Gate21.IN.45

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:**

| Parameter | Laplace transform |
|---|---|
| x(t) | X(s) |
| y(t) | Y(s) |
| $\sqrt{2}sin(t)\cdot\mu(t)$ | $\frac{1}{1+s^2}$ |
| $\frac{e^{-t}}{2}+\frac{1}{2}(sin(t)-cos(t))$ | $(\frac{1}{1+s})(\frac{1}{1+s^2})$ |

TABLE I
TRANSFORMATION

By using laplace transform,

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

$$Y(s) = G(s) \times X(s) \tag{2}$$

$$Y(s) = (\frac{1}{1+s})(\frac{1}{1+s^2}) \tag{3}$$

By finding inverse Laplace transform of Y(s),

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

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

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