

Ques 2

Ans 1 Given,

$$G(s) = \frac{2}{s^2 + 2s + 4}$$

$$\frac{\tilde{y}(s)}{\tilde{x}(s)} = \frac{2}{s^2 + 2s + 4}$$

$$\tilde{y}(s) = \frac{2}{s} \times \frac{1}{(s^2 + 2s + 4)} \quad \left[\because \text{unit step, } \tilde{x}(s) = \frac{1}{s} \right]$$

$$\text{here, } G(s) = \frac{2}{s^2 + 2s + 4}$$

$$= \frac{2}{2 \left(\frac{s^2}{4} + \frac{s}{2} + 1 \right)} = \frac{1}{\left(\frac{s^2}{4} + \frac{s}{2} + 1 \right)}$$

$$\omega_n^2 = \frac{1}{4}$$

$$\omega_n = \frac{1}{2}$$

$$\text{Also, } 2\zeta\omega_n = \frac{1}{2}$$

$$\boxed{\zeta = \frac{1}{2}}$$

$$\text{So, Percentage overshoot} = \exp\left(\frac{-\zeta\pi}{\sqrt{1-\zeta^2}}\right) \times 100\%$$

$$= \exp\left(\frac{-1.57}{0.866}\right) \times 100$$

$$= \boxed{16.313\%} \quad \underline{\underline{Ans}}$$