MECHTRON 3DX4 Tutorial Quiz 6 L02: Time Response

1. **Time Response** (10 marks)

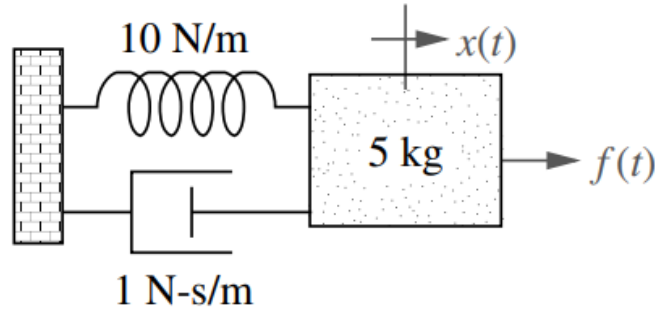   Consider the translational mechanical system in Figure 1

Figure 1: Translational System

a) (3 marks) Find the transfer function $G(s) = \frac{X(s)}{F(s)}$.

b) (7 marks) Assuming a unit step as the input, calculate ζ, ω_n, %OS, T_s, T_p, T_r, and c_{final}.

   Relevant Equations can be found on page 2!

Some relevant equations:

Peak Time:

$$T_p = \frac{\pi}{\omega_n \sqrt{1 - \zeta^2}}$$

Percent Overshoot:

$$\%OS = e^{-(\zeta\pi/\sqrt{1-\zeta^2})} \times 100$$

Settling Time:

$$T_s = \frac{4}{\zeta\omega_n}$$

Rise Time:

Damping ratio	Normalized rise time
0.1	1.104
0.2	1.203
0.3	1.321
0.4	1.463
0.5	1.638
0.6	1.854
0.7	2.126
0.8	2.467
0.9	2.883