QUIZZ 2: Systems Thinking

1. Consider the following scalar system

$$m\ddot{x} + h(x, \dot{x}) = \tau, \tag{1}$$

where $m > 0$ is a constant. Let a desired smooth (i.e., continuously differentiable) trajectory q^d is to be tracked. Answer the following

(a) Derive a PD-type controller and comment on the choice of gains such that stability is guaranteed for error dynamics. [50]

(b) Design three different set of PD gains to generate (i) underdamped (ii) critically damped and (iii) overdamped response in the tracking error [50]

2. Consider a system having open loop transfer function

$$G(s) = \frac{150(s + 1)}{(s + 5)(s + 3)} \tag{2}$$

For the above system, find the steady-state errors for the inputs (i) $tu(t)$ and (ii) $t^2 u(t)$ where $u(t)$ is the step input. [50]